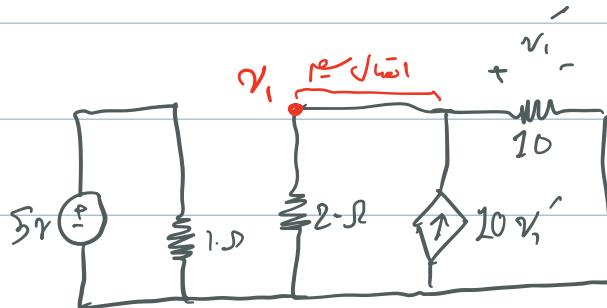
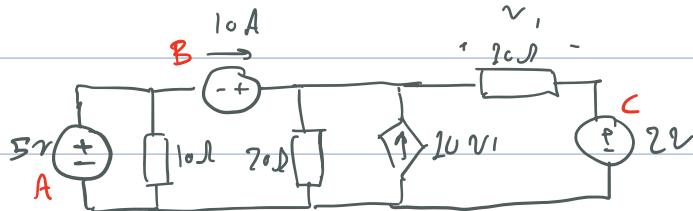


400108547

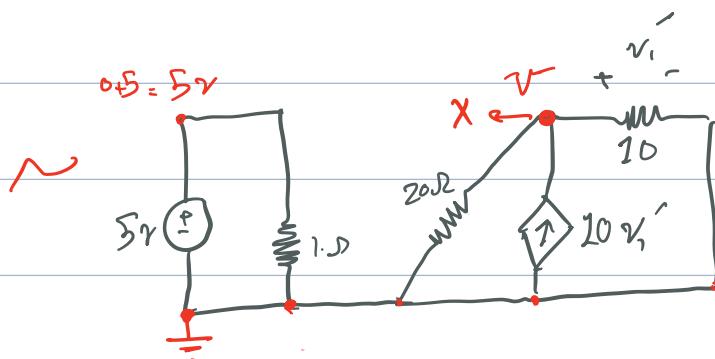
پرہام رحمانی

مارٹ

(1)



: A \rightarrow C

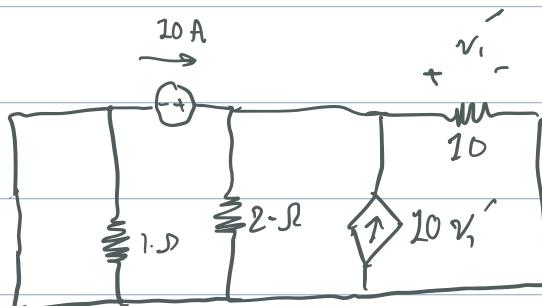


$$\Rightarrow \text{KCL at } V: \frac{V-0}{20} + -10V' + \frac{V-0}{10} = 0$$

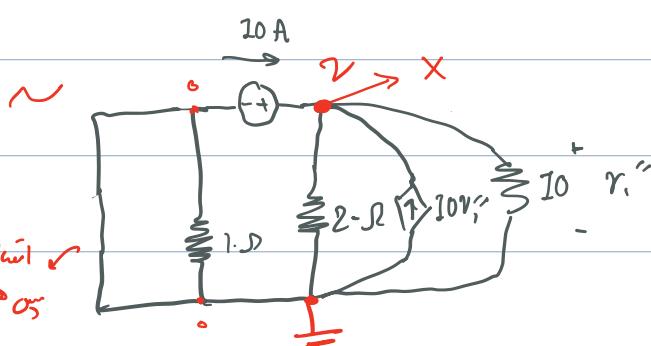
$$V' = V - 0$$

دوسرا مادت دیکھو

$$\Rightarrow \frac{3V}{20} = 10V' = 10V \Rightarrow V = 0$$



: B \rightarrow C

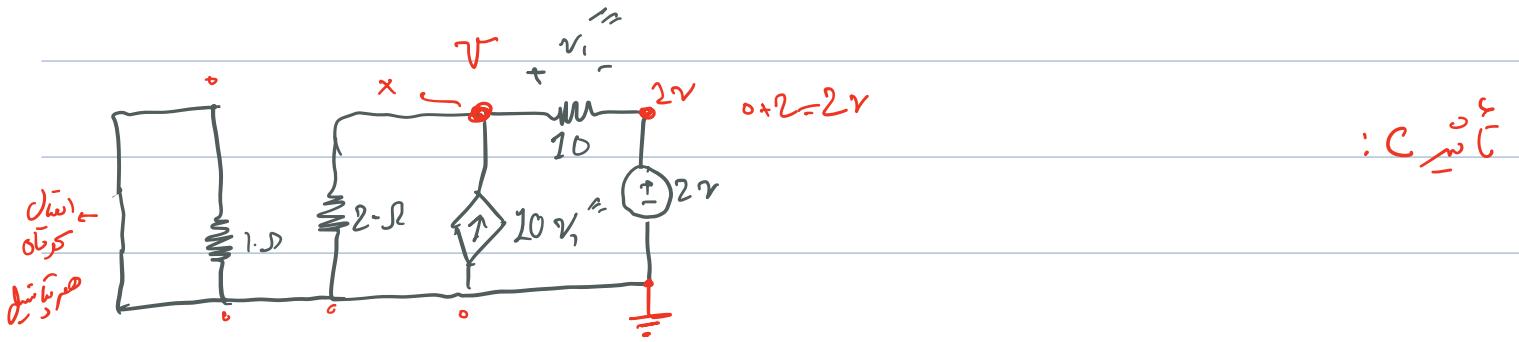


$$\text{KCL at } V: -10 + \frac{V-0}{20} - 10V'' + \frac{V-0}{10} = 0$$

$$V-0 = V''$$

$$\Rightarrow \frac{3V}{20} = 10 + 10V \Rightarrow \frac{19V}{20} = -10 \Rightarrow V = -\frac{200}{197}$$

$$\Rightarrow V = -\frac{200}{197}$$



X مکانی: $\frac{V-0}{20} - 10V''' + \frac{V-2}{10} = 0 \quad | \quad \frac{3V}{20} = 10V - 20 + \frac{1}{5}$

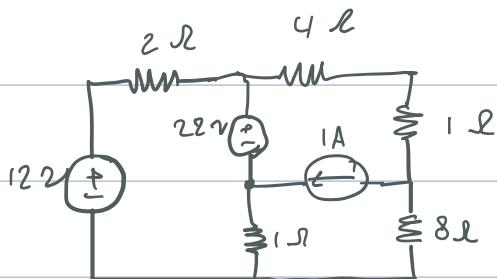
جهتی: $V''' = V - 2$

$$\Rightarrow \frac{99}{5} = \frac{197V}{20} \Rightarrow$$

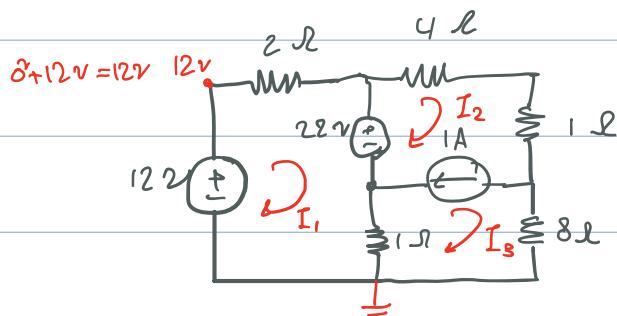
$$V = \frac{20 \times 99}{5 \times 197} = \frac{396}{197} V$$

بنابرانی اعتدال طیار درست نموده 20V (زخم مثلث) و سری $-\frac{200}{197} V$

$$\frac{396}{197} - \frac{200}{197} = \frac{196}{197} = 1 - \frac{1}{197} \gamma$$



(2)



(الف)

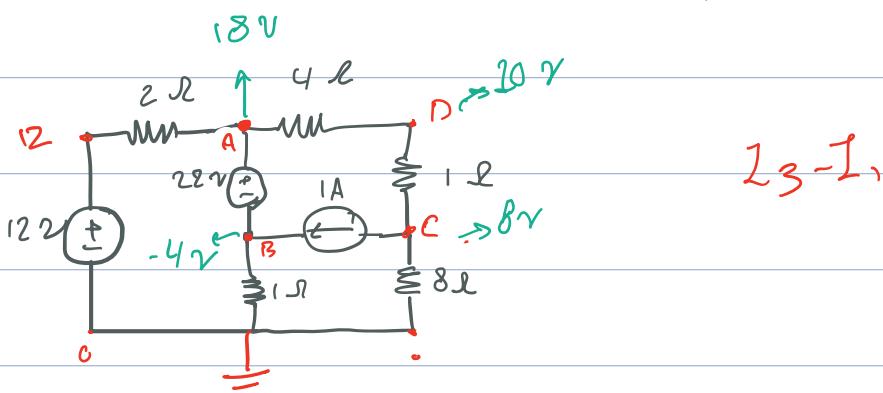
$$I_1: -12 + 2I_1 + 22 + 1(I_1 - I_3) = 0$$

$$I_3 \cup I_2: 4I_2 + 1I_2 + 8I_3 + 1(I_3 - I_1) - 22 = 0$$

$$I_2 \cap I_3: I_2 - I_3 = 1$$

$$\Rightarrow \begin{bmatrix} 3 & 0 & -1 \\ -1 & 5 & 1 \\ 0 & 1 & -1 \end{bmatrix} \vec{I} = \begin{bmatrix} -10 \\ 22 \\ 1 \end{bmatrix} \Rightarrow \vec{I} = \begin{bmatrix} -3 \\ 2 \\ 1 \end{bmatrix}$$

X مجهول بـ ٣ مجهول



$I_3 - I_1$

$$A: \frac{12 - V_A}{2} = I_1 = -3 \Rightarrow 12 - V_A - 6 \Rightarrow V_A = 18V$$

$$B: V_B + 22 = V_A - 18 \Rightarrow V_B = 18 - 22 = -4 \Rightarrow V_B = -4V$$

$$C: \frac{V_C - 0}{8} = I_3 = 1 \Rightarrow V_C = 8V$$

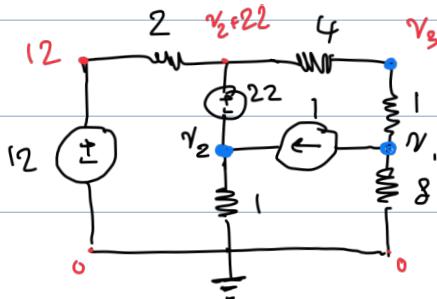
$$D: \underbrace{\frac{V_D - V_C}{1}}_{1} = I_2 = 2 \Rightarrow V_D = V_C + 2 + 8 + 2 = 10 \Rightarrow V_D = 10V$$

$$\vec{P} = \vec{V} \vec{I} = (V_B - V_C)(1) = (-4.8)1 = -12W$$

ب)

توان ۱۲W صریح آن است

* ملخص حل حصہ الف جا : KVL



پن و برد منبع ولار ساده ۱۲V و ۷۲+۲۲V و ۷۲-۲۲V ایست.
حل برآنشا کل KCL و KVL می‌باشد.
سریع تر ۷۲ و ۷۲ سریع تر.

$$V_1: \frac{(V_1 - 0)}{8} + 1 + \frac{V_1 - V_3}{1} = 0$$

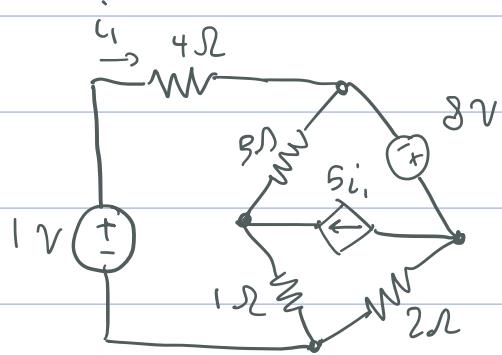
$$V_2: \frac{V_2 - 0}{1} + (-1) + \frac{V_2 + 22 - V_3}{4} + \frac{V_2 + 22 - 12}{2} = 0$$

$$V_3: \frac{V_3 - V_2 - 22}{4} + \frac{V_3 - V_1}{1} = 0$$

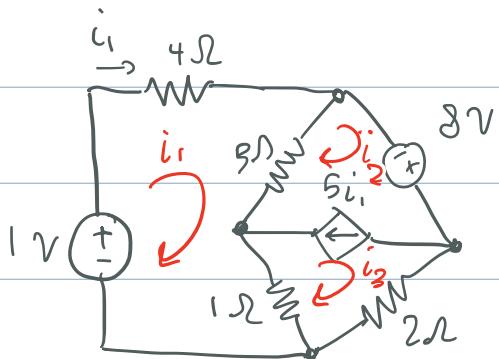
$$\Rightarrow \begin{cases} \frac{9}{8}V_1 + 0V_2 - V_3 = -1 \\ 0V_1 + \frac{7}{4}V_2 - \frac{1}{4}V_3 = \frac{-9}{2} \\ -V_1 - \frac{1}{4}V_2 + \frac{5}{4}V_3 = \frac{11}{2} \end{cases} \rightarrow \begin{bmatrix} \frac{9}{8} & 0 & -1 \\ 0 & \frac{7}{4} & -\frac{1}{4} \\ -1 & -\frac{1}{4} & \frac{5}{4} \end{bmatrix} \vec{V} = \begin{bmatrix} -1 \\ -\frac{9}{2} \\ \frac{11}{2} \end{bmatrix}$$

$$\Rightarrow \vec{V} = \begin{bmatrix} 8 \\ -4 \\ 10 \end{bmatrix}$$

(3)



: جو



$$i_1: -1 + 4i_1 + 3(i_1 - i_2) + 1(i_1 - i_3) = 0$$

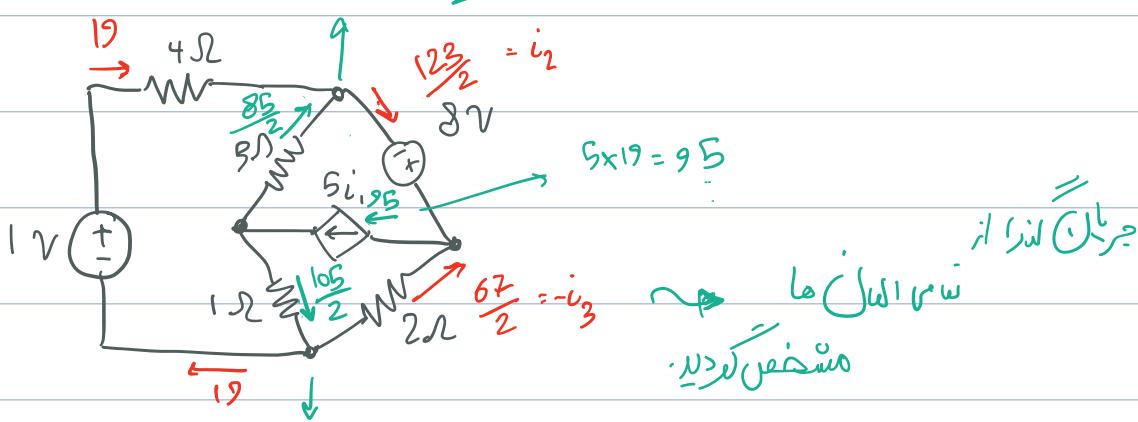
$$i_2 \text{ loop: } 3(i_2 - i_1) - 8 + 2i_3 + 1(i_3 - i_1) = 0$$

$$i_2 \cap i_3: i_2 - i_3 = 5i_1$$

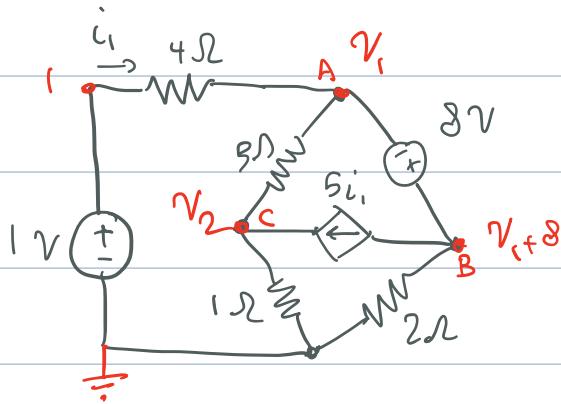
$$\begin{bmatrix} 8 & -3 & -1 \\ -4 & 3 & 3 \\ -5 & 1 & -1 \end{bmatrix} \vec{i} = \begin{bmatrix} 1 \\ 8 \\ 0 \end{bmatrix} \Rightarrow \vec{i} = \begin{bmatrix} 19 \\ 123/2 \\ -67/2 \end{bmatrix}$$

مجهول

$$x+19 = \frac{123}{2} \Rightarrow x = \frac{123-38}{2} = \frac{85}{2}$$



$$x = 19 + \frac{67}{2} = \frac{38+67}{2} = \frac{105}{2}$$



: KCL 6G

$$A \cup B: \frac{V_1 - 1}{4} + \frac{V_1 - V_2}{3} + 5i_1 + \frac{V_1 + 8 - 0}{2} = 0$$

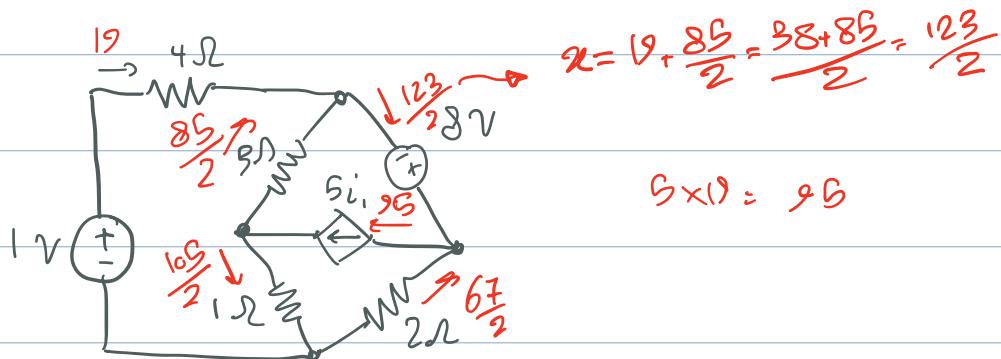
$$C: \frac{V_2 - V_1}{3} - 5i_1 + \frac{V_2 - 0}{1} = 0$$

$$4\text{G}: \frac{1 - V_1}{4} = i_1$$

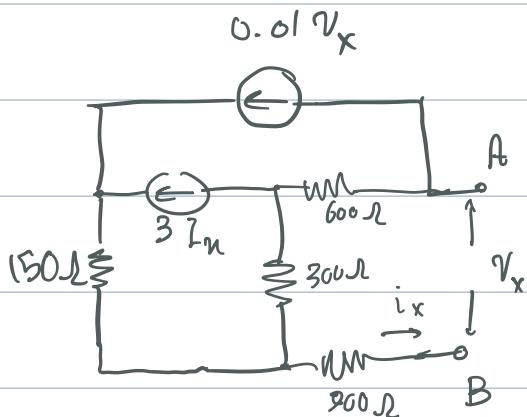
$$\begin{bmatrix} \frac{13}{12} & -\frac{1}{3} & 5 \\ -\frac{1}{3} & \frac{4}{3} & -5 \\ \frac{1}{4} & 0 & 1 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ i_1 \end{bmatrix} = \begin{bmatrix} -\frac{15}{4} \\ 0 \\ \frac{1}{4} \end{bmatrix} \Rightarrow \begin{bmatrix} V_1 \\ V_2 \\ i_1 \end{bmatrix} = \begin{bmatrix} -75 \\ \frac{105}{2} \\ 17 \end{bmatrix}$$

$$2\text{L}: \frac{V_1 + 8 - 0}{2} = -\frac{67}{2} \quad 1\text{L}: \frac{V_2 - 0}{1} = \frac{105}{2}$$

$$3\text{L}: \frac{V_1 - V_2}{3} = \frac{-75 - \frac{105}{2}}{3} = \frac{-255}{6} = -\frac{85}{2}$$

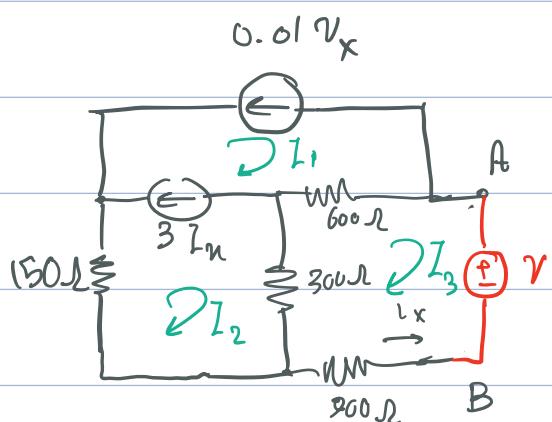


(4)



الآن) مدار صبیع مستقل شار سی نهی تواند خود تنفس دلست ایجاد کند و لذت مدار باز ۰ فی باشد.

(b)



$$\text{نحوه ۱: } I_1 = -0.01 V_x$$

$$\text{نحوه ۲: } I_1 - I_2 = 3 I_x \Rightarrow I_2 = I_1 - 3 I_x = I_1 + 3 I_3 = -0.01 V_x + 3 I_3$$

$$\text{نحوه ۳: } I_2 = -I_3$$

$$I_3: +V + 900 I_3 + 300(I_3 - I_2) + 600(I_3 - I_1) = 0$$

$$\Rightarrow V + 1800 I_3 - 300(-0.01 V_x + 3 I_3) + 600(0.01 V_x) = 0$$

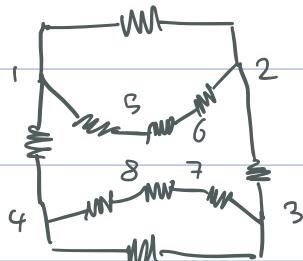
$$\Rightarrow V + 9 V_x + 900 I_3 = 0$$

$$R_{th} = \left| \frac{V}{I_3} \right|$$

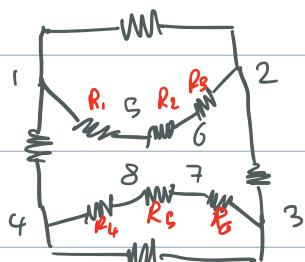
$$\text{i) if } V_x = V_B - V_A: 10V = -900 I_3 \Rightarrow \left| \frac{V}{I_3} \right| = \frac{900}{10} \boxed{90 \Omega} \xrightarrow{R_{th}}$$

$$\text{ii) if } V_x = V_A - V_B: -8V = -900 I_3 \Rightarrow \left| \frac{V}{I_3} \right| = \frac{900}{8} = \underline{\underline{112.5 \Omega}}$$

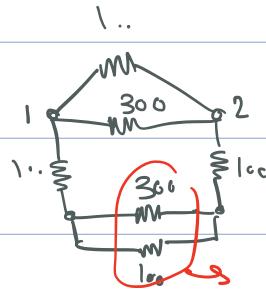
(۷۰۰ متر ۹۰ Ω) این معادله را در اینجا (معادله اول) نویسید، اما در اینجا (معادله دوم) نویسید، $V_x = 0.01 V$ نویسید.



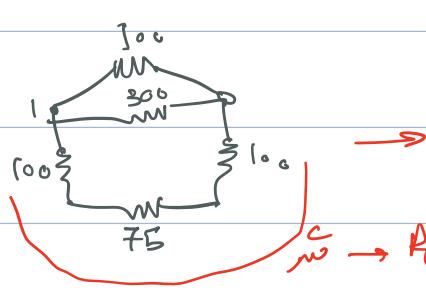
الحل



$$\begin{aligned} & \text{Req} = \sum R_i \\ & R_{1,2,3} \rightarrow \text{Req} = \sum R_i \\ & R_{4,5,6} \rightarrow \text{Req} = \sum R_i \\ & \sum I_{in} = 300 \end{aligned}$$

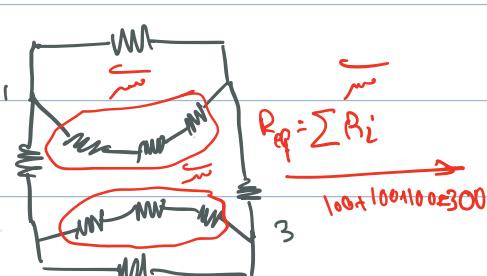


$$\text{Req} = \frac{1}{\frac{1}{300} + \frac{1}{100}} = \frac{300}{4} = 75 \Omega$$



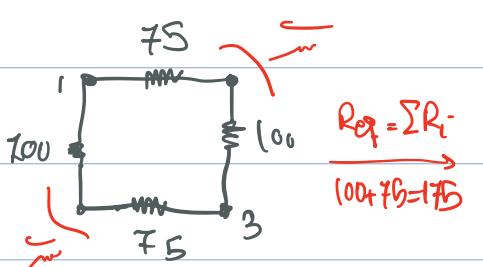
$$\frac{1}{\text{Req}} = \frac{1}{100} + \frac{1}{300} + \frac{1}{275} = \frac{14}{825}$$

$$\Rightarrow \text{Req} = 58 \frac{13}{14} = 58.928571 \Omega$$

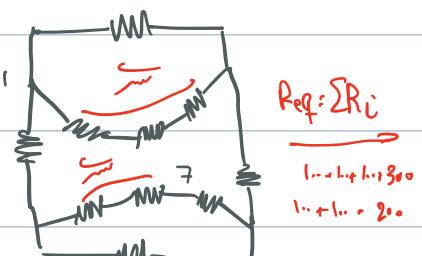


$$\begin{aligned} & \frac{1}{\text{Req}} = \sum \frac{1}{R_i} \\ & \text{Req} = \frac{1}{\frac{1}{100} + \frac{1}{300}} = \frac{300}{4} = 75 \Omega \end{aligned}$$

الحل



$$\begin{aligned} & \frac{1}{\text{Req}} = \sum \frac{1}{R_i} \\ & \text{Req} = \frac{1}{\frac{1}{125} + \frac{1}{75}} = \frac{2}{175} \\ & \rightarrow \text{Req} = \frac{175}{2} = 87.5 \Omega \end{aligned}$$

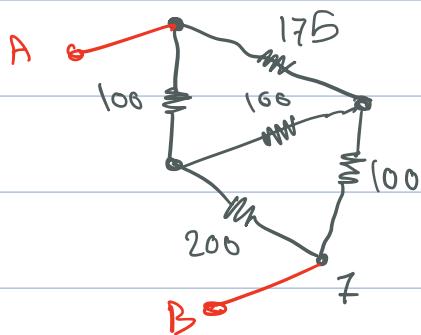


$$\begin{aligned} & \frac{1}{\text{Req}} = \sum \frac{1}{R_i} \\ & \text{Req} = \frac{1}{\frac{1}{100} + \frac{1}{200}} = \frac{200}{3} = 75 \Omega \end{aligned}$$

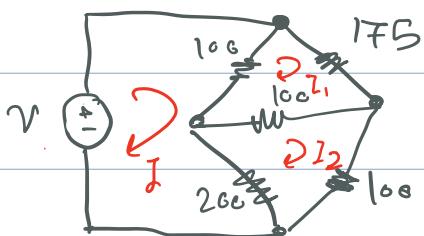
$$\begin{aligned} & \frac{1}{\text{Req}} = \sum \frac{1}{R_i} \\ & \text{Req} = \frac{1}{\frac{1}{100} + \frac{1}{100} + \frac{1}{200} + \frac{1}{100}} = \frac{400}{7} = 57.14 \Omega \\ & 100 + 75 = 175 \end{aligned}$$

الحل

(6)



برای محاسبه مقاومت محدودین از روش زیر است (نماینده نمودار):



$$I_1 : 175 I_3 + 100(I_1 - I_2) + 100(I_4 - I) = 0$$

$$I_2 : 100 I_2 + 200(I_2 - I) + 100(I_2 - I_1) = 0$$

$$I : -V + 100(I - I_1) + 200(I - I_2) = 0$$

$$\begin{bmatrix} -100 & 375 & -100 \\ -200 & -100 & 400 \\ 300 & -100 & -200 \end{bmatrix} \begin{bmatrix} I \\ I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ V \end{bmatrix}$$

* محاسبه در آنها بیانی کافی است V کی حالت دستگیر. I بحسب V در میانه.

و لог $V=1$ \rightarrow اولیه

$$\begin{array}{l} \text{جهت فرم} \\ \Rightarrow \end{array} \begin{bmatrix} I \\ I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} \frac{7}{950} \\ \frac{3}{950} \\ \frac{17}{3800} \end{bmatrix} \Rightarrow R_{th} = \left(\frac{V}{I} \right) + \frac{1}{\frac{7}{950}} = \frac{950}{7} \Omega$$

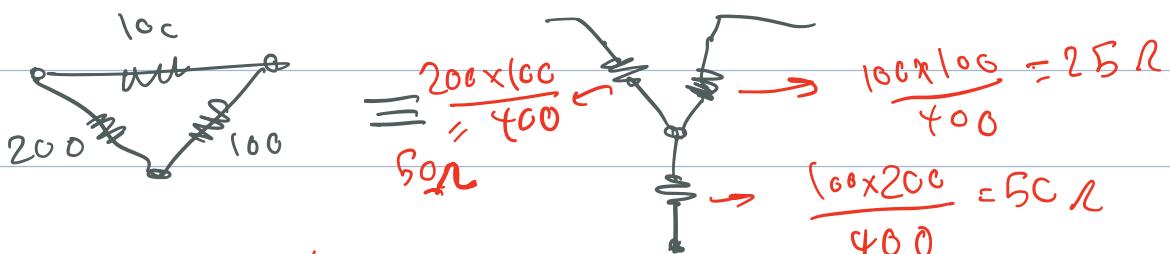
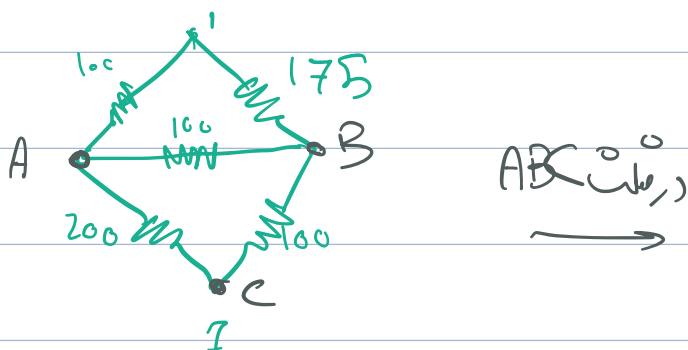
Wye-Delta



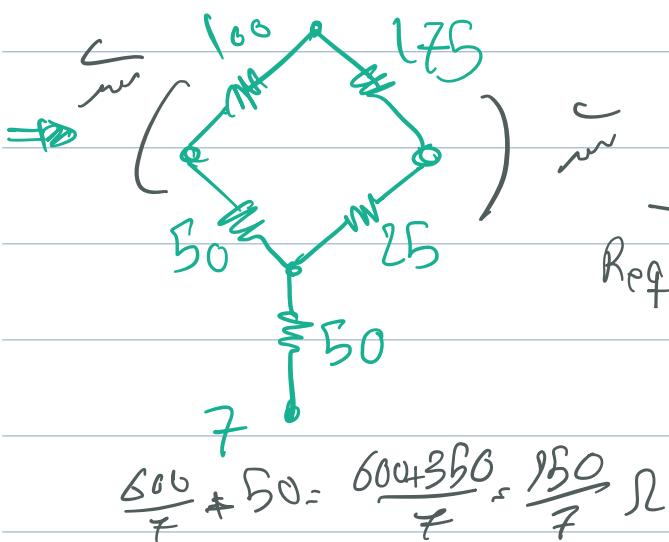
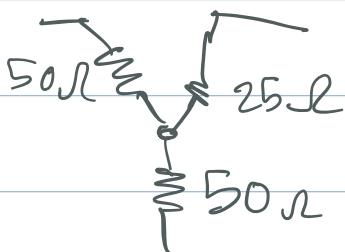
$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$

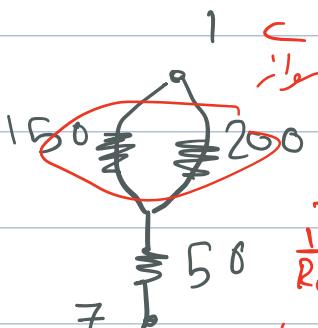
$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$



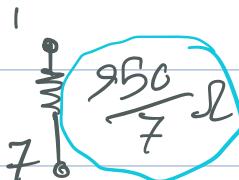
$$100 + 100 + 200 = 400$$



$$R_{eq} = \sum R_i$$

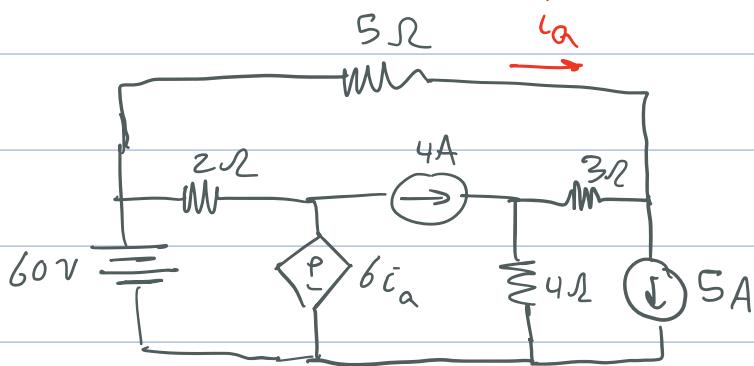


$$\frac{1}{150 + 1/200} = \frac{600}{7}$$

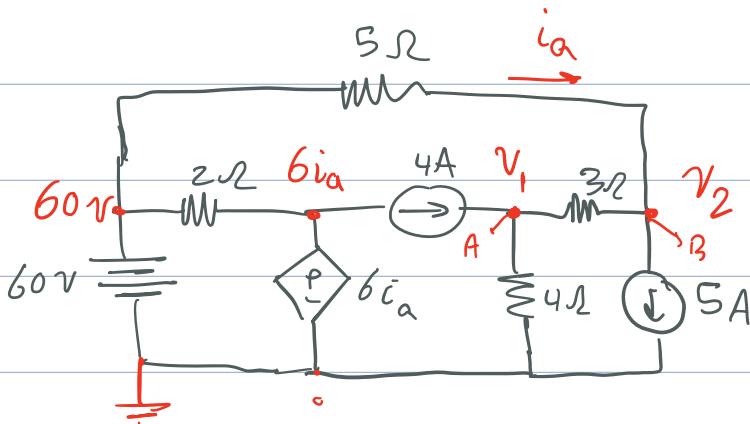


$$R_{eq} = \sum R_i$$

(6)



: do



$$A \rightarrow KCL: -4 + \frac{V_1 - 0}{4} + \frac{V_1 - V_2}{3} = 0$$

$$B \rightarrow KCL: \frac{V_2 - V_1}{3} + 5 + \frac{V_2 - 60}{5} = 0$$

$$\text{مقطورة} \\ \frac{60 - V_2}{5} = i_a$$

$$\begin{bmatrix} \frac{1}{12} & -\frac{1}{3} \\ -\frac{1}{3} & \frac{8}{15} \end{bmatrix} \vec{v} = \begin{bmatrix} 4 \\ 7 \end{bmatrix} \Rightarrow \vec{v} = \begin{bmatrix} \frac{67}{3} \\ \frac{325}{12} \end{bmatrix}$$

$$i_a = \frac{60 - \frac{325}{12}}{5} = \frac{395}{60} \text{ A}$$

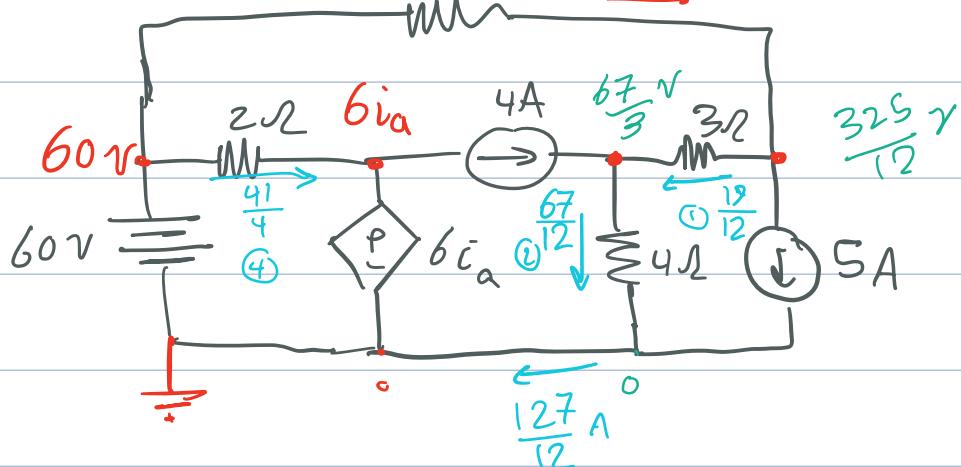
$$P = VI = (V_2 + 0) \times 5 = \frac{-325}{12} \times 5 = \frac{1625}{12} \text{ W} \therefore 5 \text{ A} \text{ متوافق} *$$

$$\therefore \text{work} = \frac{1625}{12} \text{ W} \Leftrightarrow \text{work} \approx 135.4 \text{ W}$$

in J'

5Ω

$$i_a = \frac{395}{60} = \frac{79}{12}$$



$$\textcircled{1} \quad \frac{\frac{67}{3} - \frac{325}{12}}{3} = -\frac{19}{12} \text{ A}$$

$$\textcircled{2} \quad n = \frac{19}{12} + 4 = \frac{67}{12} \text{ A}$$

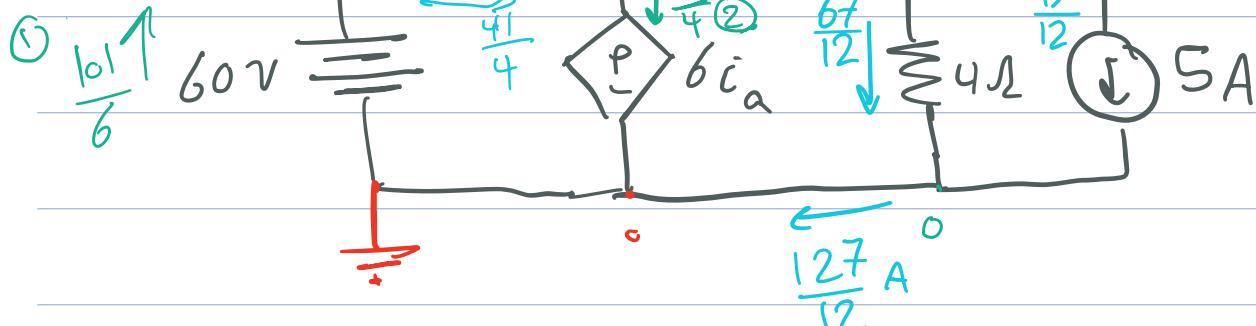
$$\textcircled{3} \quad 5 + \frac{67}{12} = \frac{127}{12} \text{ A}$$

$$\textcircled{4} \quad \frac{6i_a - 0}{2} = \frac{395 - 60}{2} = -\frac{41}{4}$$

$$i_a = \frac{395}{60} = \frac{79}{12}$$

$6i_a$

5Ω



$$\textcircled{1} \quad n = \frac{41}{4} + \frac{79}{12} \Rightarrow n = \frac{123 + 79}{12} = \frac{202}{12} = \frac{101}{6} \text{ A}$$

$$\textcircled{2} \quad n + 4 = \frac{41}{4} \Rightarrow n = \frac{41 - 16}{4} = \frac{25}{4} \text{ A}$$

$$\frac{101}{6} \times 60 = 1010 \text{ W} \quad \text{in ملء} \quad : 60 \text{ ملء}$$

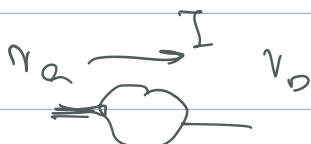
$$6i_a \times \frac{-25}{4} = 6 \times \frac{79}{12} \times \frac{-25}{4} = -\frac{1975}{8} \text{ W} \quad \text{in ملء توليد} : 6i_a \text{ ملء} \star$$

$$\left(\left(\frac{79}{12} \times 6 + \frac{67}{3} \right) \times 4 \right) \times 4 = -\frac{103 \times 4}{6} = -\frac{206}{3} \text{ W} \quad \text{in ملء توليد} \quad : 4A \text{ ملء} \star$$

$\frac{206}{3} \text{ W}$ درجه حراره

$$P = VI = (75+0) \times 5 = \frac{-325}{12} \times 5 = \frac{1625}{12} \text{ W} \quad : 5A \text{ ملء توليد} \star$$

in ملء $\frac{1625}{12} \text{ W} \Leftrightarrow$ in ملء $\approx 135.4 \text{ W}$



$$\Delta V I = P$$