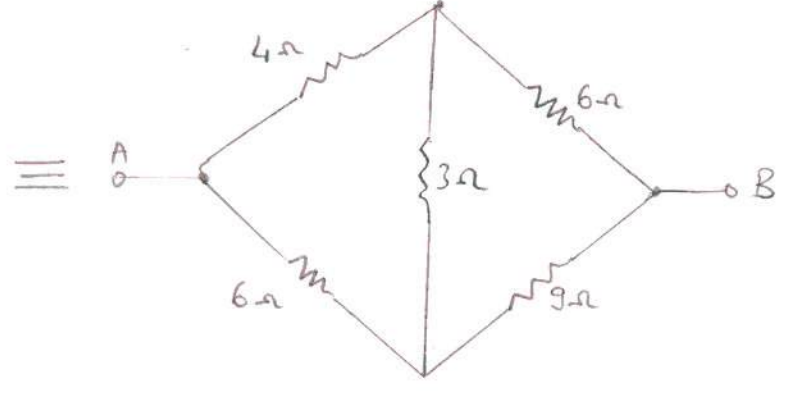
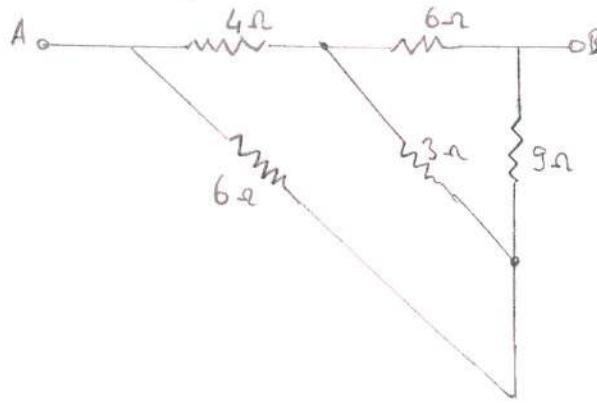


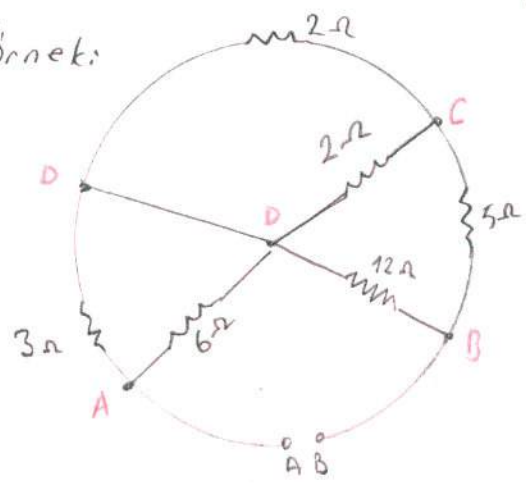
## ÖRNEK SORULAR (DC)

Örnek: Şekildeki devrenin A-B noktaları arasında 12 V uygulandığında  $3\Omega$ 'luk dirençten geçen akımı bulunuz.

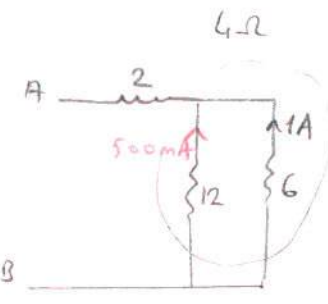
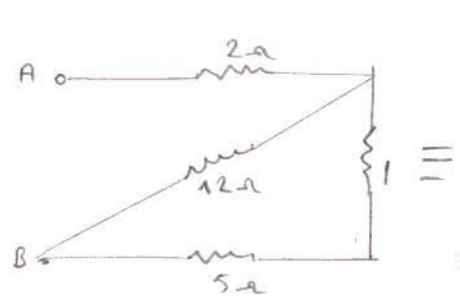
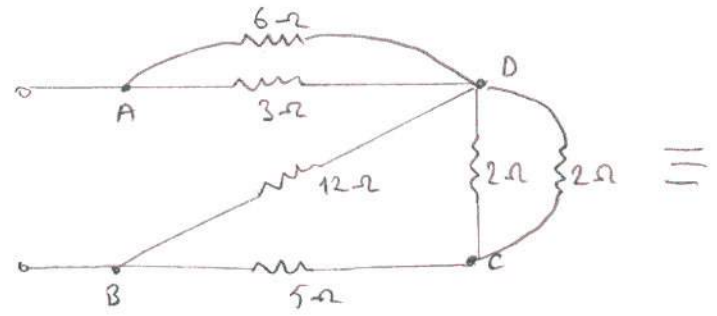


Devre Wheatstone köprüsüdür ve dengededir.  $6 \cdot 6 = 4 \cdot 9 = 36$ . Bu yüzden  $3\Omega$ 'luk dirençten akım geçmez.

Örnek:



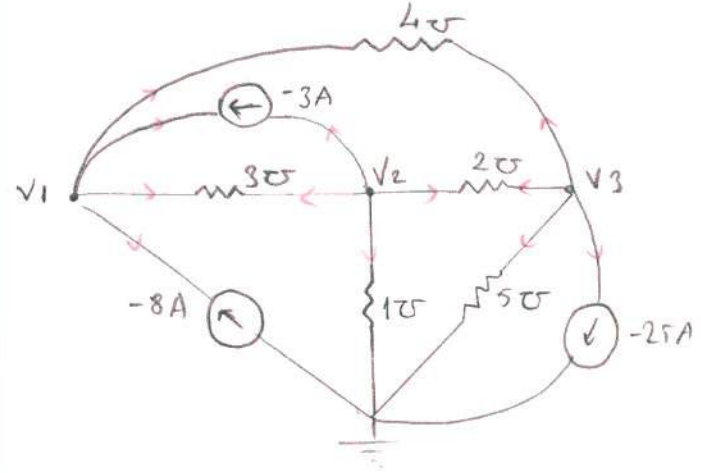
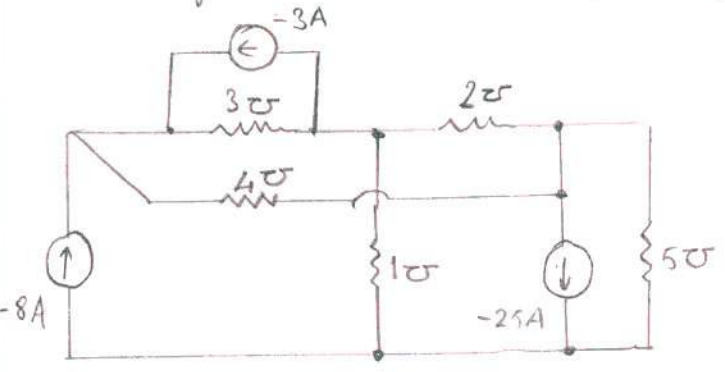
Şekildeki devrede  $12\Omega$ 'luk dirençten geçen akım  $500\text{mA}$  olduğuna göre A-B noktaları arasındaki potansiyel farkı bulunuz?



$12\Omega$ 'luk dirençten  $0,5\text{A}$  akım geçerse  $6\Omega$ 'luk dirençten  $1\text{A}$  akım geçer.  $2\Omega$ 'luk dirençten ise  $0,5+1=1,5\text{A}$  akım geçer.

$U_{AB} = R_{es} \cdot 1,5 = 6 \cdot 1,5 = 9\text{V}$  bulunur.

Örnek: Aşağıdaki devrenin düğüm gerilimlerini hesaplayınız.



1. düğüm noktası için;  
 $3(V_1 - V_2) + 4(V_1 - V_3) - (-8) - (-3) = 0$   
 $7V_1 - 3V_2 - 4V_3 = -11 \dots \text{I}$

2. düğüm noktası için;  
 $3(V_2 - V_1) + 1 \cdot V_2 + 2(V_2 - V_3) - 3 = 0$   
 $-3V_1 + 6V_2 - 2V_3 = 3 \dots \text{II}$

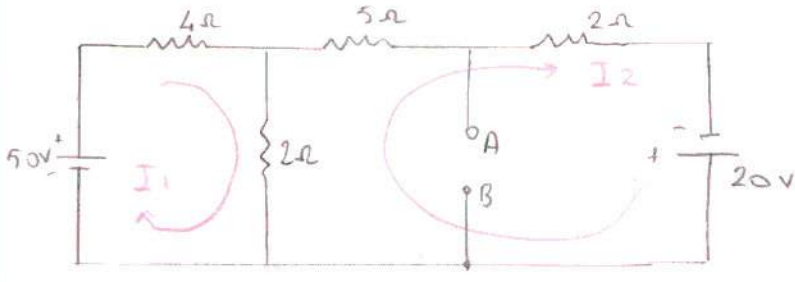
3. düğüm noktası için  
 $4(V_3 - V_1) + 2(V_3 - V_2) + 5V_3 - 25 = 0$   
 $-4V_1 - 2V_2 + 11V_3 = 25 \dots \text{III}$

$$\left. \begin{array}{l} 7V_1 - 3V_2 - 4V_3 = -11 \\ -3V_1 + 6V_2 - 2V_3 = 3 \\ -4V_1 - 2V_2 + 11V_3 = 25 \end{array} \right\} V_1 = \frac{\begin{vmatrix} -11 & -3 & -4 \\ 3 & 6 & -2 \\ 25 & -2 & 11 \end{vmatrix}}{\begin{vmatrix} 7 & -3 & -4 \\ -3 & 6 & -2 \\ -4 & -2 & 11 \end{vmatrix}} = \frac{191}{191} \Rightarrow V_1 = 1 \text{ Volt}$$

$$V_2 = \frac{\begin{vmatrix} 7 & -11 & -4 \\ -3 & 3 & -2 \\ -4 & 25 & 11 \end{vmatrix}}{\begin{vmatrix} 7 & -3 & -4 \\ -3 & 6 & -2 \\ -4 & -2 & 11 \end{vmatrix}} = \frac{382}{191} \Rightarrow V_2 = 2 \text{ Volt}$$

$$V_3 = \frac{\begin{vmatrix} 7 & -3 & -11 \\ -3 & 6 & 3 \\ -4 & -2 & 25 \end{vmatrix}}{\Delta} = \frac{573}{191} \Rightarrow V_3 = 3 \text{ Volt}$$

Örnek: Şekildeki devrede A-B uçlarına bağlanan;  $1\Omega, 2\Omega$  ve  $3\Omega$ 'lük dirensten geçecek akımları bulunuz.



$$50 = 6I_1 - 2I_2$$

$$20 = 9I_2 - 2I_1$$

$$3I_1 - I_2 = 25 \times (4,5)$$

$$-I_1 + 4,5I_2 = 10$$

$$13,5I_1 - 4,5I_2 = 112,5$$

$$-I_1 + 4,5I_2 = 10$$

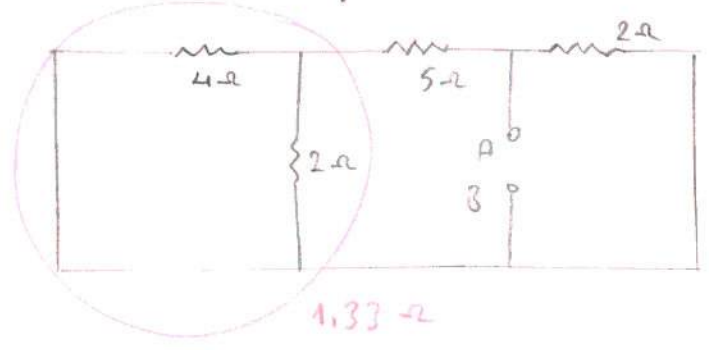

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$$12,5I_1 = 122,5$$

$$I_1 = 9,8A, I_2 = 4,4A$$

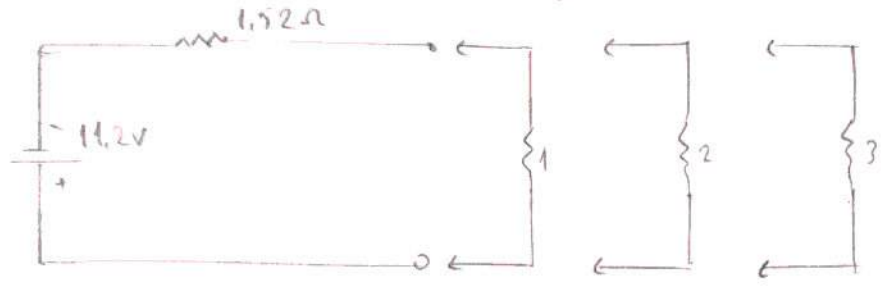
$$U_{AB} = 20 - 2 \cdot I_2 = 20 - 2 \cdot 4,4 = \underline{11,2 \text{ Volt}}$$

A-B noktalarına göre eşdeğer direnç;



$$R_{A-B} = 6,33 // 2 = 1,52\Omega$$

Devrenin Thevenin eşdeğeri:

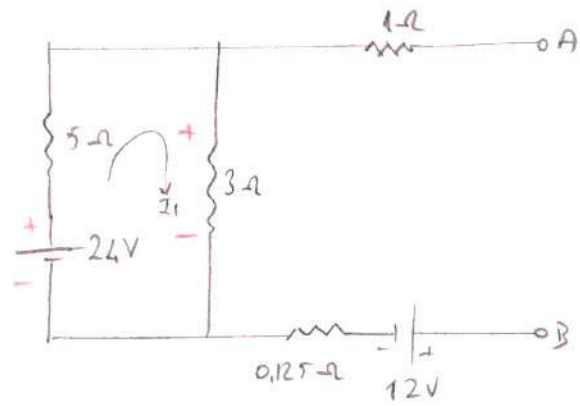
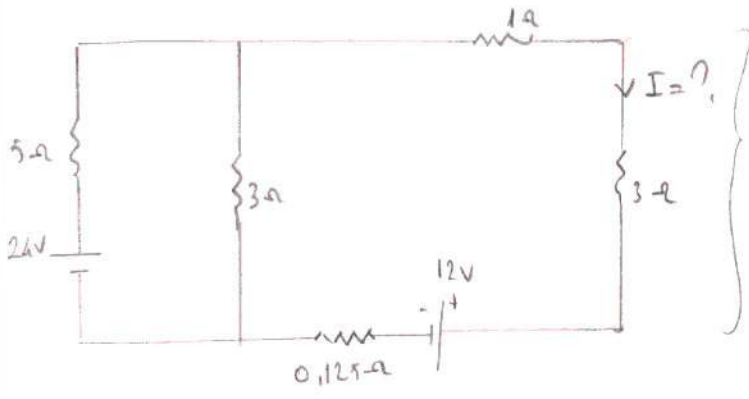


$$I_{1\Omega} = \frac{11,2}{1,52+1} = 4,44A$$

$$I_{2\Omega} = \frac{11,2}{1,52+2} = 3,18A$$

$$I_{3\Omega} = \frac{11,2}{1,52+3} = 2,48A$$

Örneki şekildedeki devrede  $I$  akımını Thevenin teoreminde yararlanarak bulunuz.



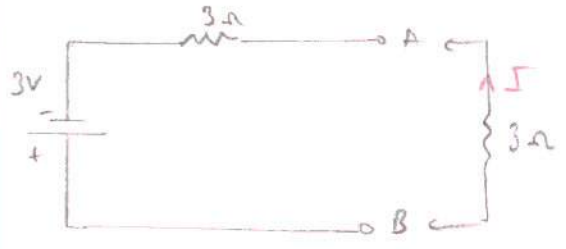
$$I_1 = \frac{24}{8} = 3A$$

$$U_{3\Omega} = 3 \cdot 3 = 9V$$

3Ω'lık direnç üzerine düşen gerilim;  
 $U_{3\Omega} = \frac{24}{5+3} \cdot 3 = 9V$  volt

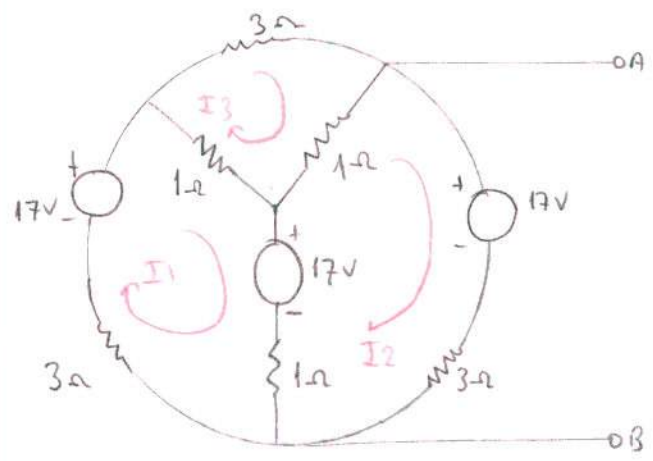
1Ω'lık ve 0,125Ω'lık dirençlerde akım geçmeyeceği için A-B arası gerilim;  $U_{A-B} = 12 - 9 = 3V$  volt.

$$R_{A-B} = 5 // 3 + 1 + 0,125 = 3\Omega$$



$$I_{3\Omega} = \frac{3V}{6\Omega} = 0,5A \text{ bulunur.}$$

Örneki şekildedeki devrenin A-B arası Thevenin eşdeğeri gerilim kaynağını bulunuz.



$$17 - 17 = 5I_1 - I_2 - I_3$$

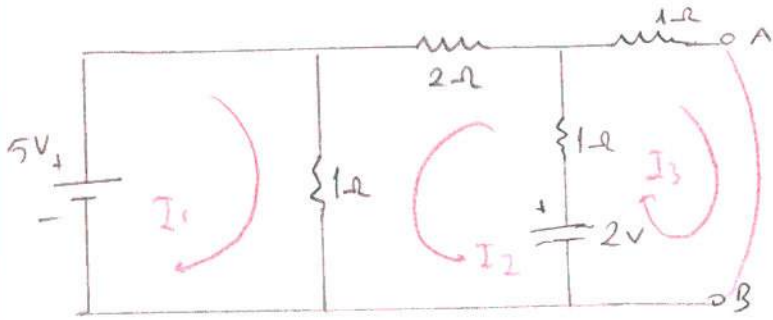
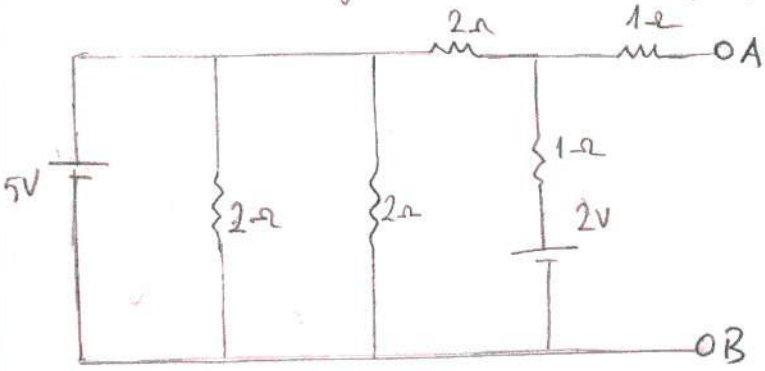
$$17 - 17 = -I_1 + 5I_2 - I_3$$

$$0 = -I_1 - I_2 + 5I_3$$

$$I_2 = \frac{\Delta_2}{\Delta} = \frac{\begin{vmatrix} 5 & 0 & -1 & 5 & 0 \\ -1 & 0 & -1 & -1 & 0 \\ -1 & 0 & 5 & -1 & 0 \\ 5 & -1 & -1 & 5 & -1 \\ -1 & 5 & -1 & -1 & 5 \\ -1 & -1 & 5 & -1 & -1 \end{vmatrix}}{\Delta} = 0A$$

$$U_{A-B} = 17 - 3 \cdot 0 = 17V \text{ volt}$$

Örnek: Norton eşdeğerindeki akım kaynağı ve direnç değerini bulunuz.



$$1 \cdot I_1 + 1 \cdot I_2 + 0 \cdot I_3 = 5$$

$$1 \cdot I_1 + 4 \cdot I_2 + 1 \cdot I_3 = 2$$

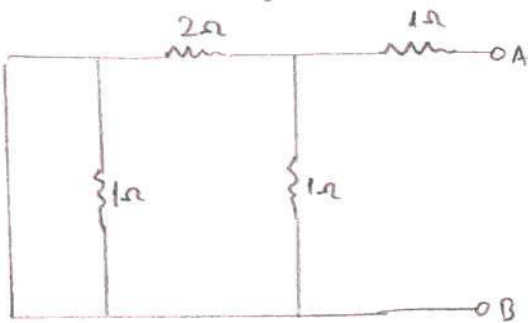
$$0 \cdot I_1 + 1 \cdot I_2 + 2 \cdot I_3 = 2$$

$$\Delta = \begin{vmatrix} 1 & 1 & 0 \\ 1 & 4 & 1 \\ 0 & 1 & 2 \end{vmatrix} \begin{vmatrix} 5 \\ 2 \\ 2 \end{vmatrix} = 8 - (1+2) = 5$$

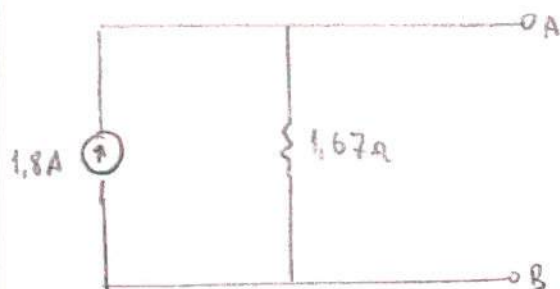
$$\Delta_3 = \begin{vmatrix} 1 & 1 & 5 \\ 1 & 4 & 2 \\ 0 & 1 & 2 \end{vmatrix} \begin{vmatrix} 1 \\ 1 \\ 0 \end{vmatrix} = (8+5) - (2+2) = 13 - 4 = 9$$

$$I_3 = \frac{\Delta_3}{\Delta} = \frac{9}{5} = 1,8A$$

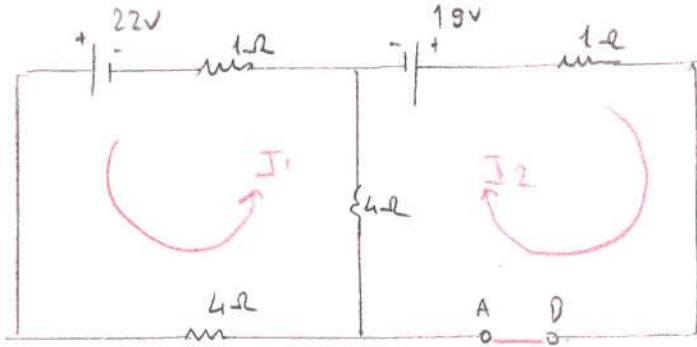
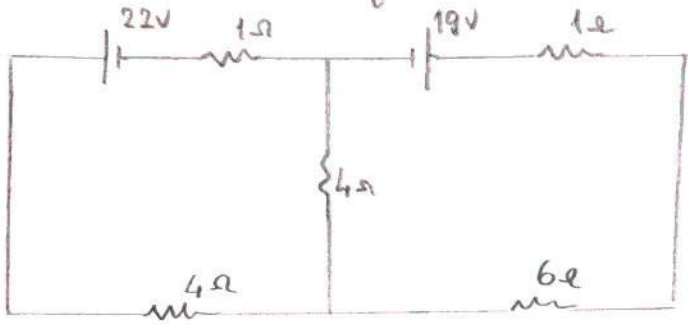
AB arası eşdeğer direnci,



$$R_{A-B} = (1 // 2) + 1 = 1,67\Omega$$



Örnek:  $6\Omega$ 'lık dirençten geçen akım, norton teoreminin yararlanarak bulunur.



$$\begin{cases} 4I_1 + 9I_1 + 4I_2 = 22 \\ -6I_1 + 4I_1 + 5I_2 = 19 \end{cases}$$

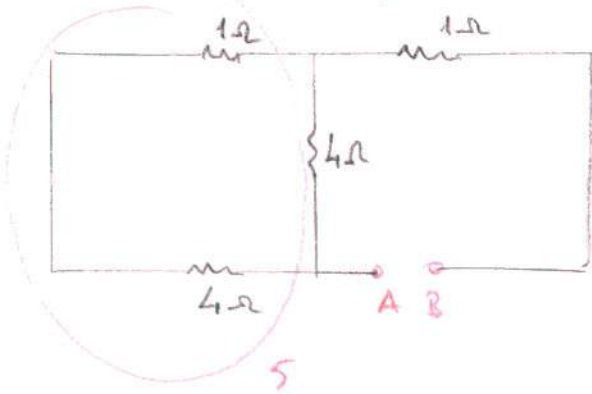
$$36I_1 + 16I_2 = 88$$

$$-36I_1 - 45I_2 = -171$$

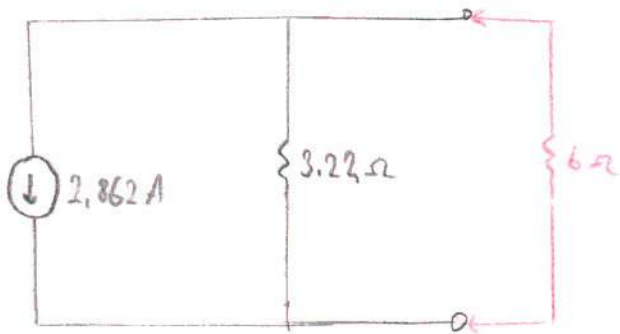
$$-29I_2 = -83$$

$$\underline{I_2 = 2,862 A}$$

A-B arası eşdeğer direnç

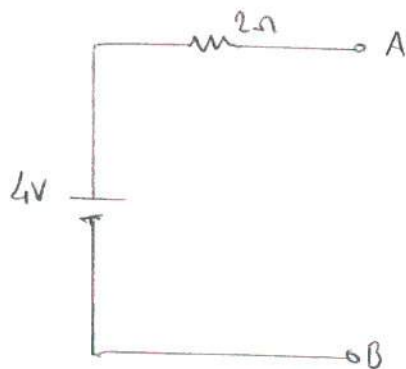
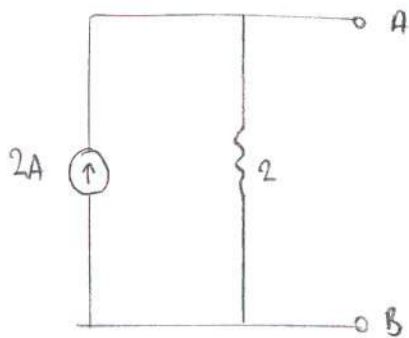
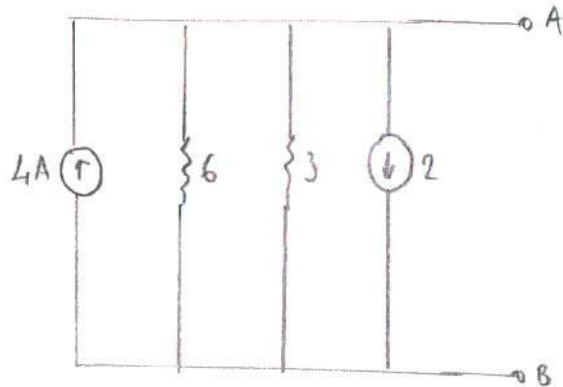
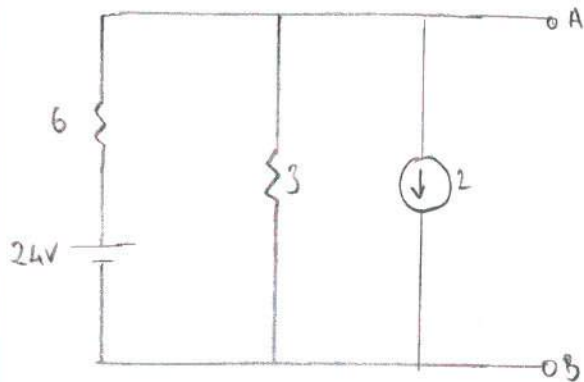
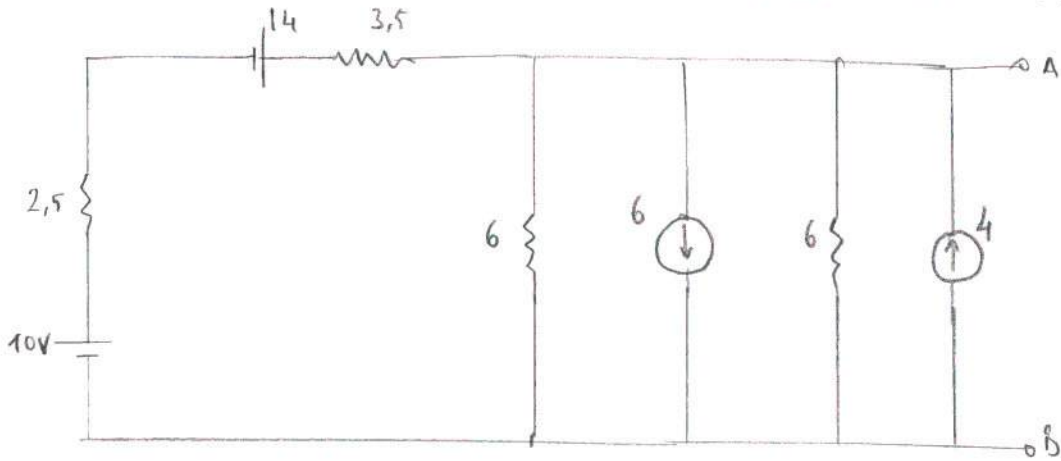
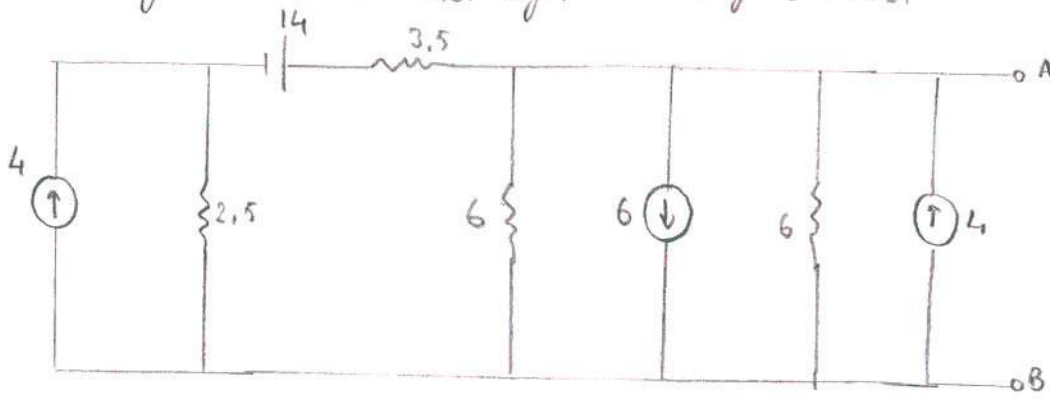


$$R_{A-B} = (4 // 5) + 1 = 3,22 \Omega \text{ dir.}$$

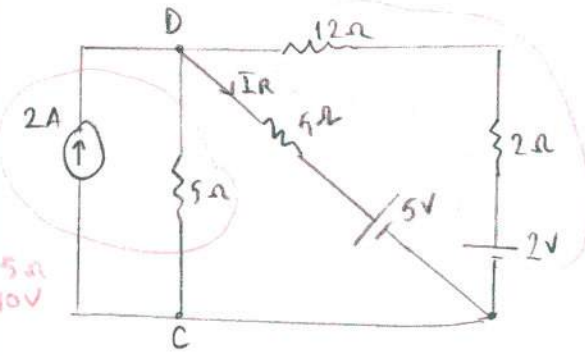


$$I_{6\Omega} = 2,862 \cdot \frac{3,22}{3,22 + 6} = 1 A \text{ bulunur.}$$

Örnek: Kaynak dönüşüme metoduyla  $V_{A-B}$ 'yi bulunuz.

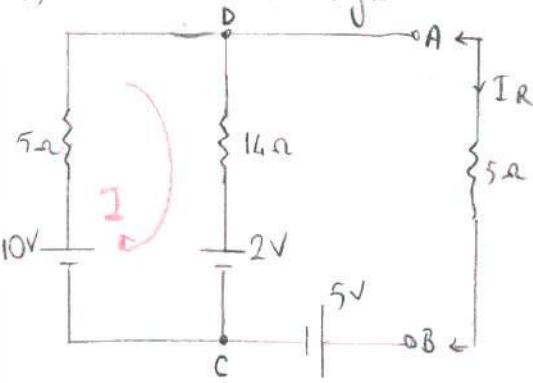


Örnek: Şekildeki devrede  $I_R$  akımını Thevenin teoremiyle ve düğüm gerilimleri yöntemiyle bulunuz.



14Ω 2V

a) Thevenin teoremiyle



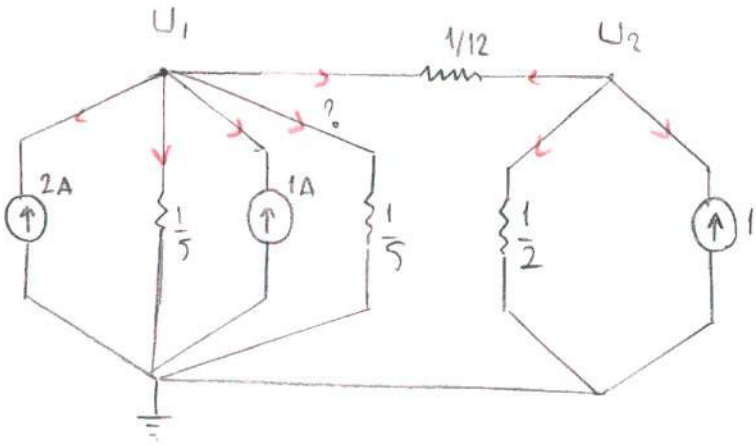
$$R_{Th} = \frac{14 \cdot 5}{14 + 5} = \frac{70}{19} \Omega$$

$$10 - 2 = I \cdot 19 \Rightarrow I = \frac{8}{19} \text{ Amper}$$

$$U_{AB} = U_{14} + 2 - 5 = 14 \cdot \frac{8}{19} + 2 - 5 = \frac{55}{19} \text{ Volt}$$

$$I_R = \frac{55/19}{5 + 70/19} = \frac{1}{3} \text{ A bulunur.}$$

b) Düğüm gerilimleri yöntemiyle



$$-2 + \frac{U_1}{5} - 1 + \frac{U_1}{5} + \frac{U_1 - U_2}{12} = 0$$

$$\left(\frac{2}{5} + \frac{1}{12}\right) \cdot U_1 - \frac{1}{12} U_2 = 3 \quad \dots \text{I}$$

$$\frac{U_2 - U_1}{12} + \frac{U_2}{2} - 1 = 0$$

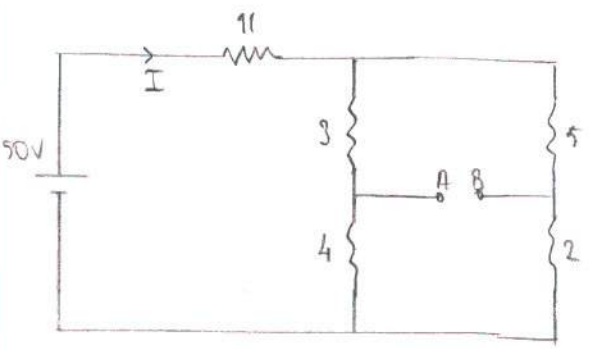
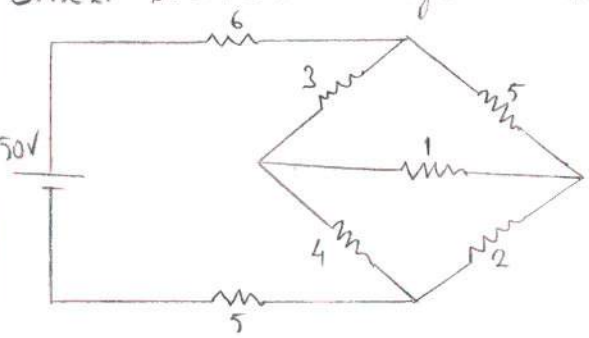
$$-\left(-\frac{1}{12}\right) U_1 + \left(\frac{7}{12}\right) U_2 = 1 \quad \dots \text{II}$$

Bu denklemlerden;  $U_1 = \frac{220}{33} \text{ V}$  bulunur.

$$I_R = \frac{U_1 - 5}{5} = \frac{\frac{220}{33} - 5}{5} = \frac{55}{33} \cdot \frac{1}{5} = \frac{11}{33} = \frac{1}{3} \text{ A bulunur.}$$



Örnek: Şekildeki devreye Thevenin Teoremini uygulayarak  $I_{1\Omega}$  akımını bulunuz.

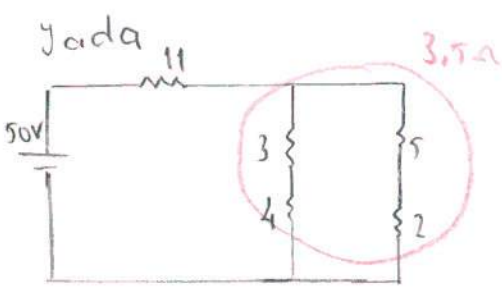
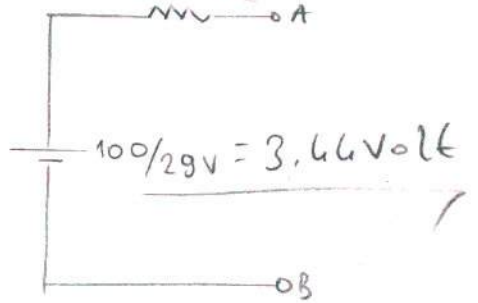
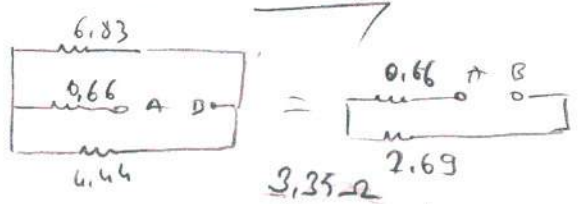
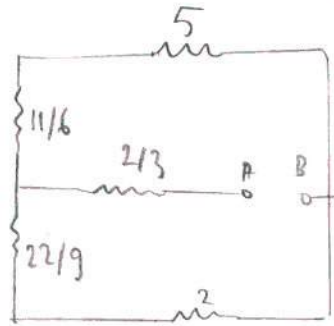
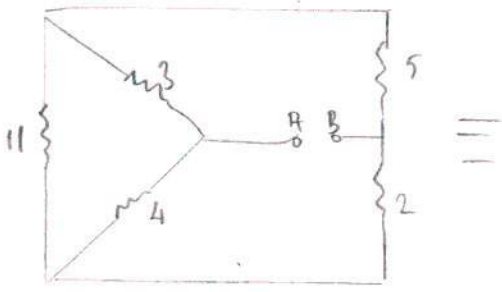


Kaynağa göre;  
 $R_T = 11 + (4+3) // (5+2)$   
 $R_T = 14,5 \Omega$   
 $I = \frac{50}{14,5} \Rightarrow I_1 = I_2 = \frac{I}{2} = \frac{50}{29} A$

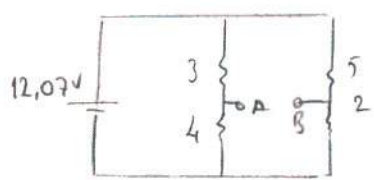
$U_A = \frac{50}{29} \cdot 4 = \frac{200}{29}$   
 $U_B = \frac{50}{29} \cdot 2 = \frac{100}{29}$

$U_A - U_B = \frac{200}{29} - \frac{100}{29} = \frac{100}{29} V = 3,44 Volt$

$R_{TH} \Rightarrow$



$V_{3,5\Omega} = 12,07 Volt$   
 $V_{11\Omega} = 37,93 Volt$



$V_{TH} = \frac{4}{4+3} \cdot 12,07 - \frac{2}{5+2} \cdot 12,07 = \frac{2}{7} \cdot 12,07 \Rightarrow V_{TH} = V_A - B = 3,44 Volt$

$I_{1\Omega} = \frac{3,44}{14,35} = 0,23 A$