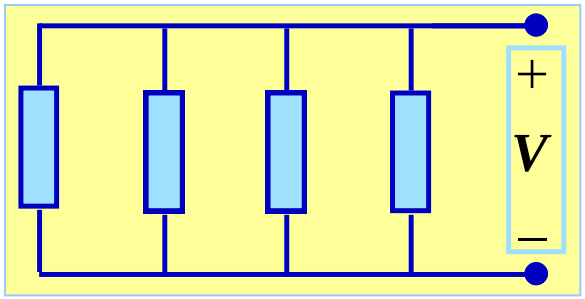
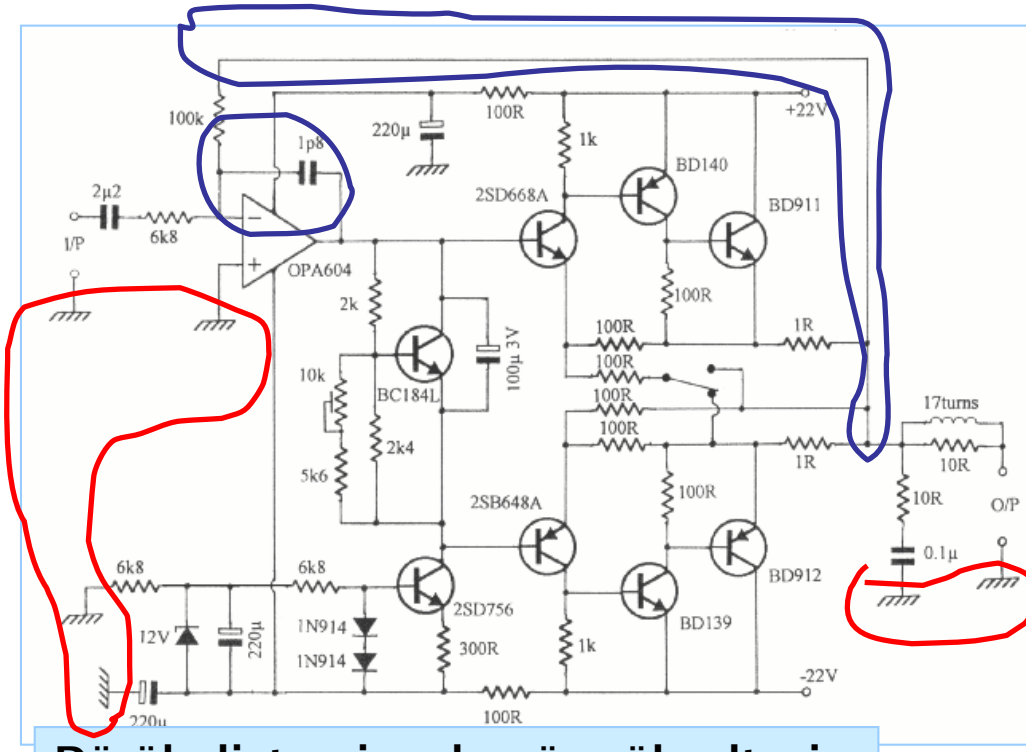
# TEK DÜĞÜM ÇİFTLİ DEVRELER

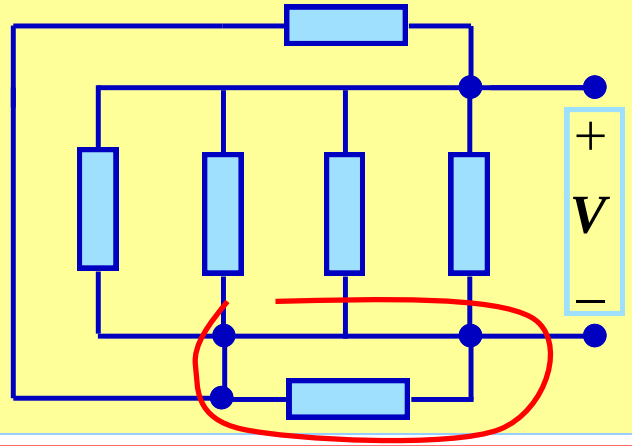
Bu devrelerin özellikleri, üzerlerinde aynı gerilime sahip olan elemanlardan Oluşmasıdır.



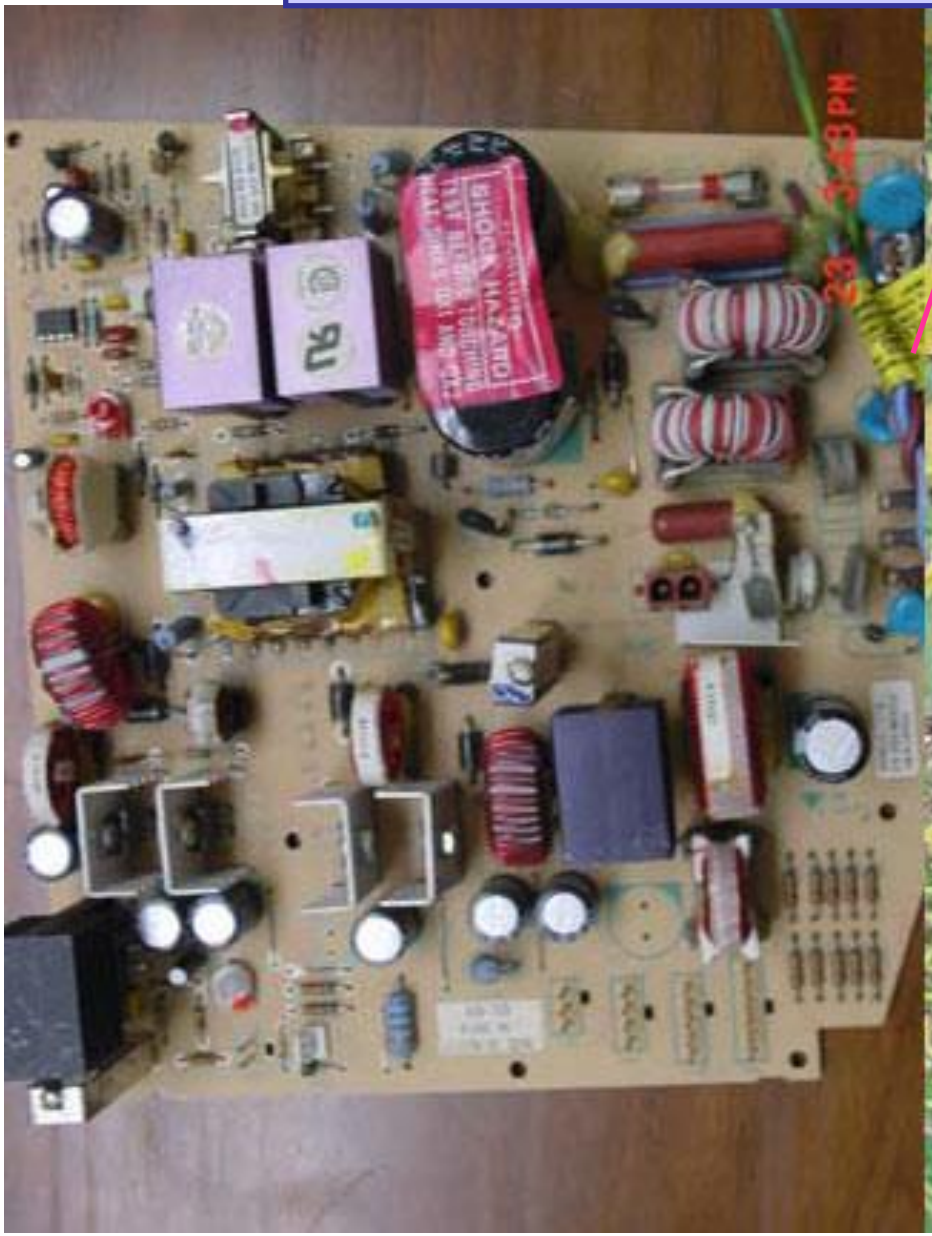

Düşük distorsiyonlu güç yükseltesi

## EXAMPLE OF SINGLE NODE-PAIR




BU ELEMAN ETKİN DEĞİLDİR (KISA DEVRE

# CRT İÇİN ALÇAK GERİLİMLİ GÜÇ KAYNAĞI – KISMİ GÖRÜNTÜ

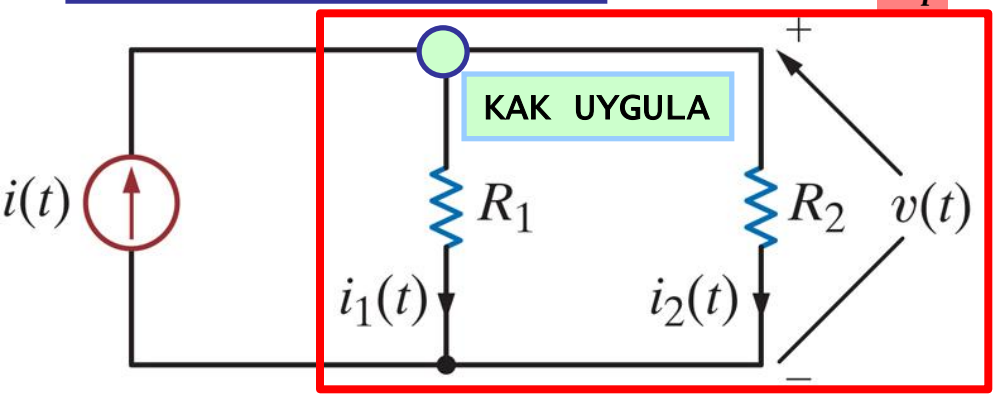





ELEMAN TARAFI

BAĞLANTI TARAFI

# TEMEL AKIM BÖLÜCÜ




AKIM BÖLÜŞÜMÜ

$$i_1(t) = \frac{v(t)}{R_1} \qquad i_2(t) = \frac{v(t)}{R_2}$$

$$i_1(t) = \frac{R_2}{R_1 + R_2} i(t) = \frac{R_1}{R_1 + R_2} i(t)$$

*i(t)* AKIMI DÜĞÜME GİRMEKTE VE BÖLÜNMEKTEDİR
AKIM *i1(t)* VE *i2(t)* ARASINDA BÖLÜNMEKTEDİR

$$i(t) = i_1(t) + i_2(t)$$

AKIMLARLA YER DEĞİŞTİRMEK İÇİN OHM KANUNUNU KULLANIN

$$i(t) = \frac{v(t)}{R_1} + \frac{v(t)}{R_2} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right) v(t)$$

"PARALEL DİRENÇ KOMBİNASYONUNU" KULLANIN

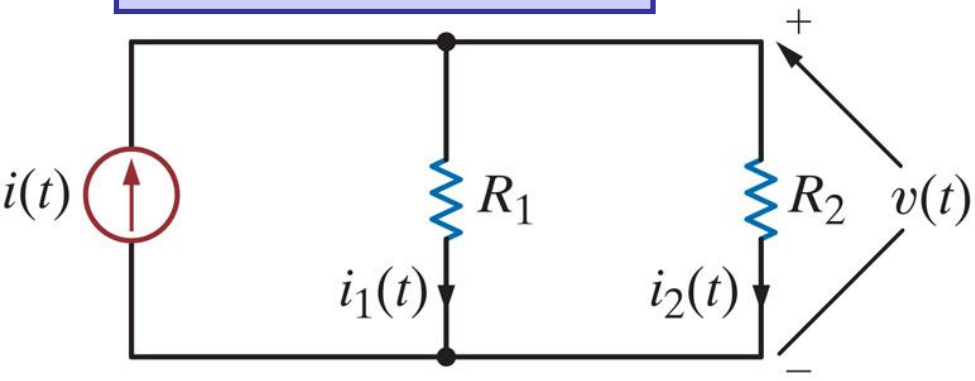
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_p = \frac{R_1 R_2}{R_1 + R_2}$$

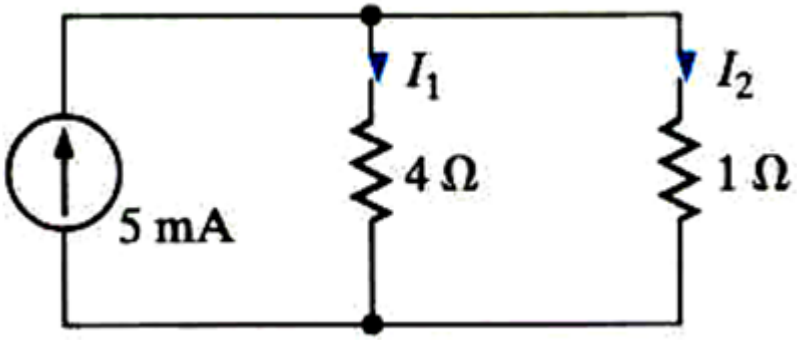
$$i(t) = \frac{1}{R_p} v(t)$$

$$v(t) = \frac{R_1 R_2}{R_1 + R_2} i(t)$$

## TEMEL AKIM BÖLÜCÜ



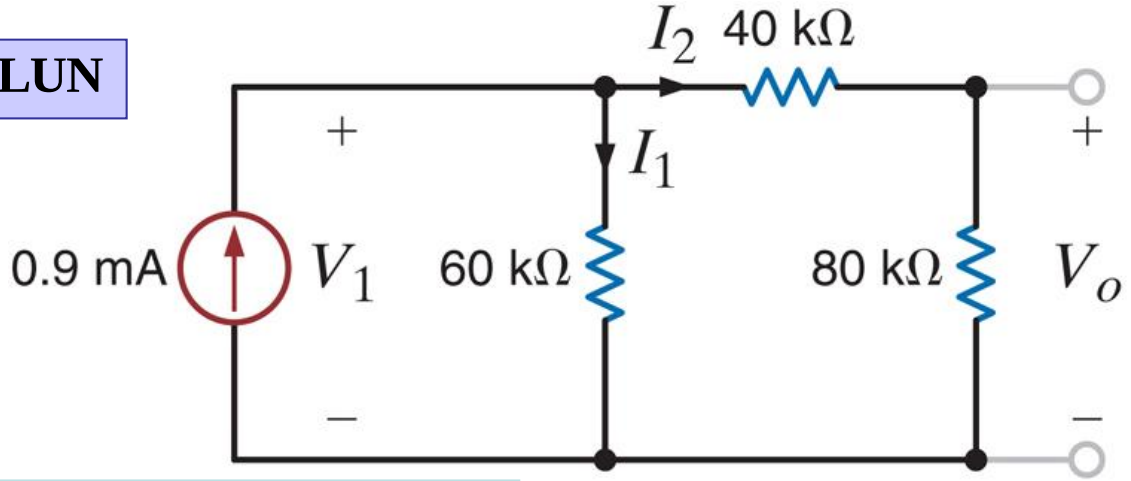

## I1 ve I2 AKIMLARINI BULUN



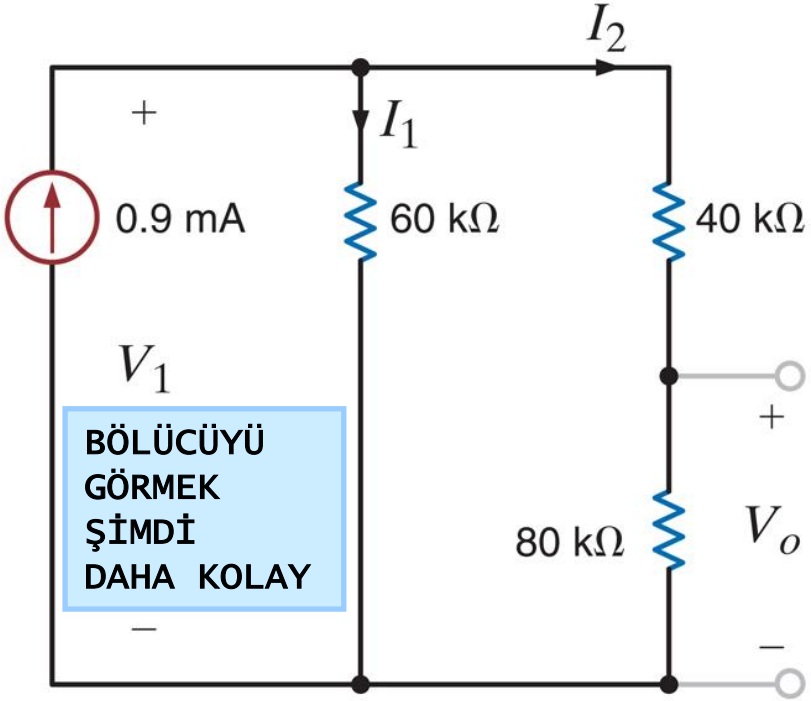

$$I_1 = \frac{1}{1+4}(5) = 1mA$$

$$I_2 = I - I_1 = \frac{4}{1+4}(5)$$

**$I_1, I_2, V_o$ BULUN**




Şüpheniz olduğunda ...
elektrik bağlantılarını vurgulamak için devreyi yeniden çizin!




BÖLÜCÜYÜ GÖRMEK ŞİMDİ DAHA KOLAY

$$I_1 = \left[\frac{40k + 80k}{60k + (40k + 80k)}\right](0.9 \times 10^{-3})$$

$$= 0.6\ \text{mA}$$

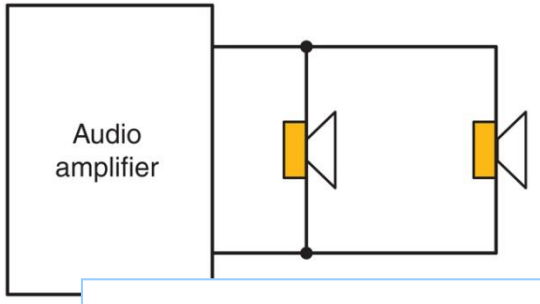
$$I_2 = \left[\frac{60k}{60k + (40k + 80k)}\right](0.9 \times 10^{-3})$$

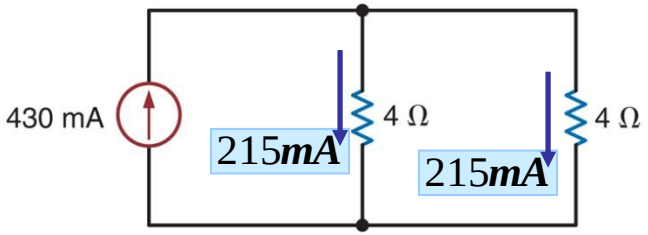
$$= 0.3\ \text{mA}$$

$$= 80k * I_2$$

$$24V$$

## ARABA STEREO VE DEVRE MODELİ



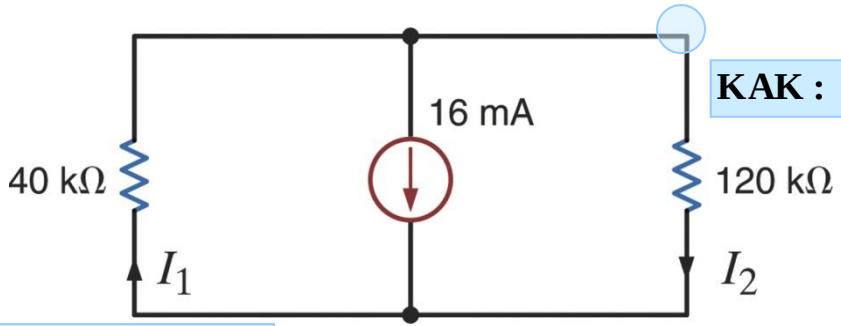

$$P = I^2R$$
$$= (215 \times 10^{-3})^2(4)$$
$$= 184.9\ \text{mW}$$

HERBİR HOPARLÖRÜN GÜCÜ $P = I^2R$

## ÖRNEK – AKIM BÖLÜCÜ

I2 HESAPLAMAK İÇİN BİRDEN FAZLA YOL VARDIR

I1 ve I2 akımlarını ve 40 kohm direnç tarafından tüketilen gücü bulun




KAK : $I_2 + 16 - I_1 = 0$

**AKIM BOLUCU KULLANARAK**

$$I_2 = -\frac{40}{120+40}(16) = -4mA$$

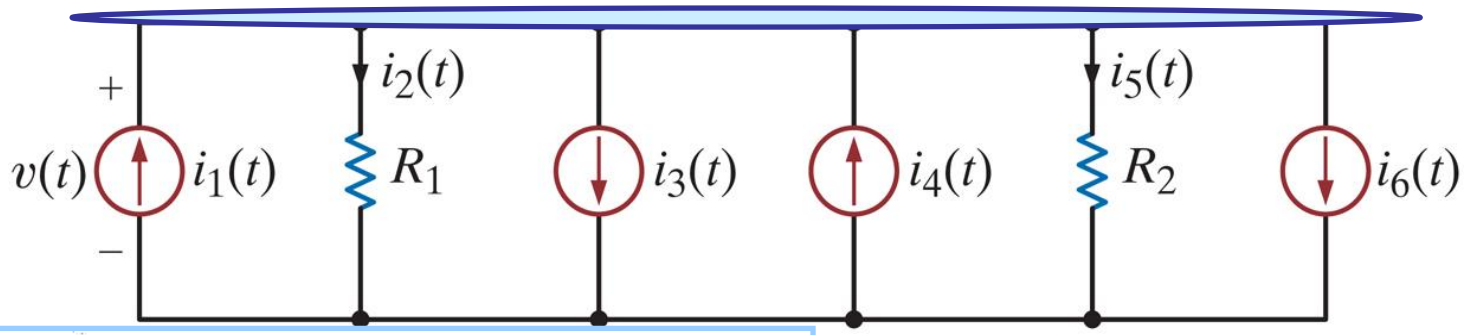
$$I_1 = \frac{120}{120+40}(16) \quad I_1 = 12mA$$

**Güc : $I^2R$**
**Direnc (kΩ),**
**Akim (mA) , Uretilen Güc (mW)**

$$P = (12*10^{-3})^2 * 40 * 10^3 = 5.76W$$

# ÇOKLU KAYNAKLAR

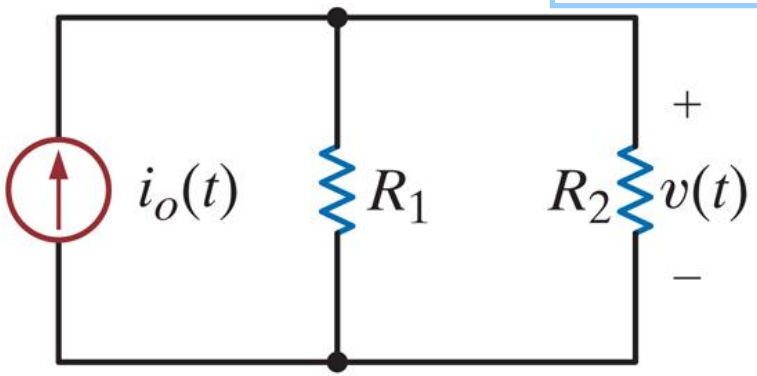
BU DÜĞÜME KAK UYGULAYIN




$$i_1(t) - i_2(t) - i_3(t) + i_4(t) - i_5(t) - i_6(t) = 0$$

## ESDEGER KAYNAK

$$i_o(t) = i_1(t) - i_3(t) + i_4(t) - i_6(t)$$




"PARALEL DİRENÇ KOMBİNASYONUNU" TANIMLAYIN

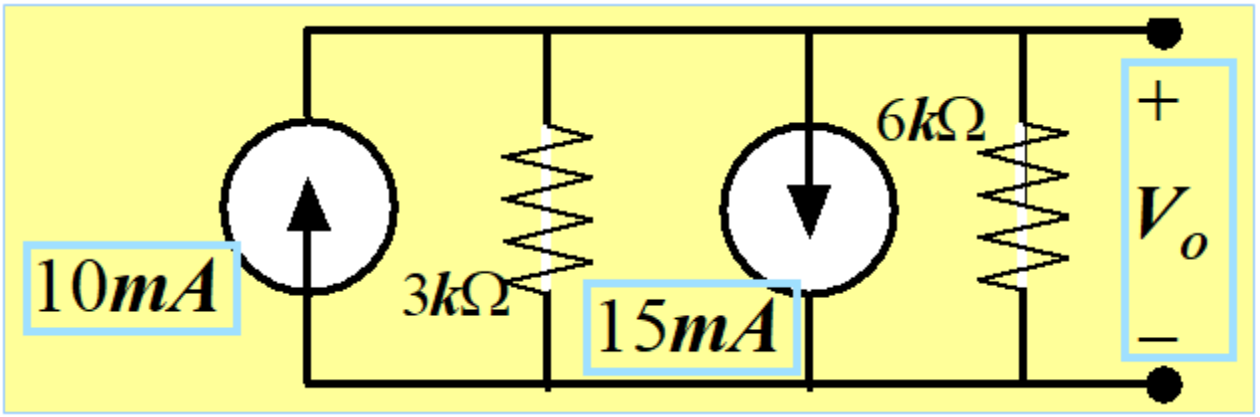
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

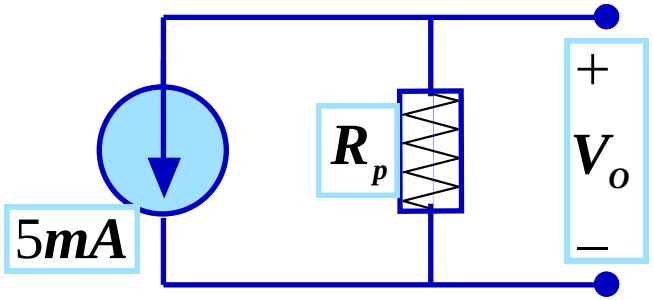
$$R_p = \frac{R_1 R_2}{R_1 + R_2}$$

$$i_o(t) = \frac{1}{R_p} v(t)$$

$$v(t) = \frac{R_1 R_2}{R_1 + R_2} i_o(t)$$

## Vo VE KAYNAKLAR TARAFINDAN SAĞLANAN GÜCÜ BULUN




$$R_p = \frac{6k * 3k}{6k + 3k} = 2k\Omega$$

$$V_O = -10V$$

$$P_{15mA} = V_O(15mA)$$

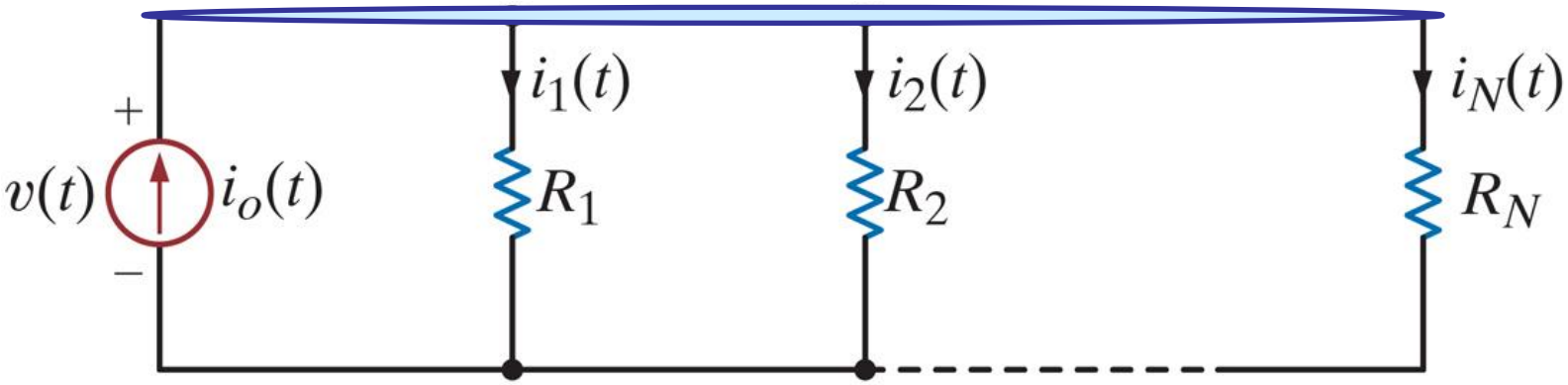
$$= -150mW$$

$$P_{10mA} = V_O(-10mA)$$

$$= 100mW$$

# ÇOKLU DİRENÇLER

BU DÜĞÜME KAK UYGULAYIN




$$i_o(t) = i_1(t) + i_2(t) + \cdots + i_N(t)$$
$$= \left(\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}\right) v(t)$$

Her direnç için Ohm Kanunu

$$\frac{1}{R_p} = \sum_{i=1}^{N} \frac{1}{R_i}$$

$$i_o(t) = \frac{v(t)}{R_p}$$

$$\left.\begin{aligned} v(t) &= R_P i_O(t) \\ i_k(t) &= \frac{v(t)}{R_k} \end{aligned}\right\} \Rightarrow i_K(t) = \frac{R_p}{R_k} i_O(t)$$

Genel akım bölücü

## PROBLEM-SOLVING STRATEGY

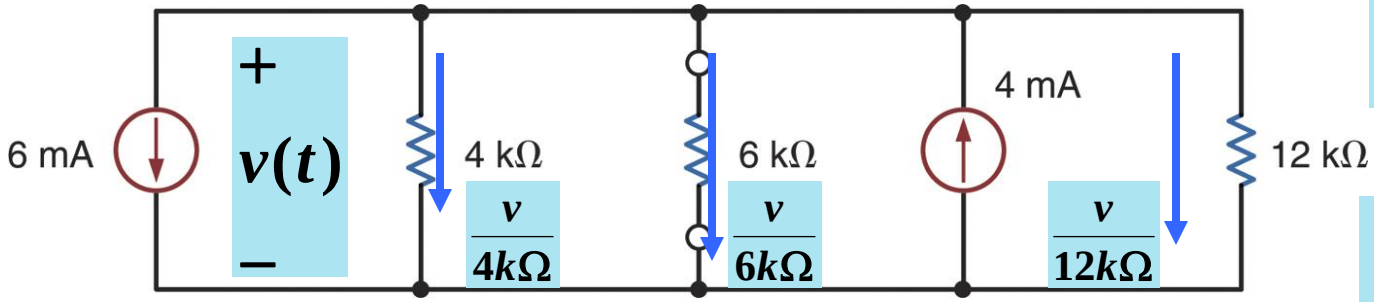
SINGLE-NODE-PAIR CIRCUITS

**STEP 1.** Define a voltage $v(t)$ between the two nodes in this circuit. We know from KVL that there is only one voltage for a single-node-pair circuit. A polarity is assigned to the voltage such that one of the nodes is assumed to be at a higher potential than the other node, which we will call the reference node.

**STEP 2.** Using Ohm's law, define a current flowing through each resistor in terms of the defined voltage.

**STEP 3.** Apply KCL at one of the two nodes in the circuit.

**STEP 4.** Solve the single KCL equation for $v(t)$. If $v(t)$ is positive, then the reference node is actually at a lower potential than the other node; if not, the reference node is actually at a higher potential than the other node.




Pasif işaret kuralına dikkat edin

$v(t)$ bilinirse diğer bütün değişkenler belirlenebilir; e.g.,

$$KCL: 6mA + \frac{v}{4k\Omega} + \frac{v}{6k\Omega} - 4mA + \frac{v}{12k\Omega} = 0 \quad \times 12k\Omega$$

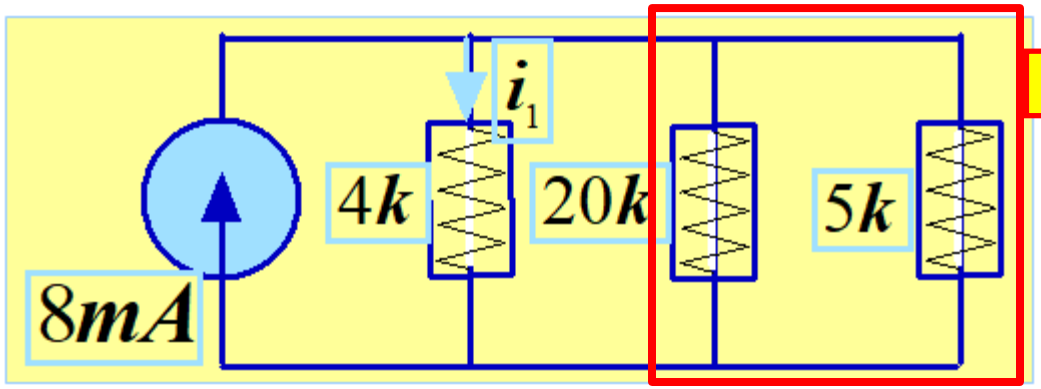
$$72V + 3v + 2v - 48V + v = 0$$

$$24V + 6v = 0$$

$$v = -4V$$

$$P_{6k\Omega} = \frac{v^2}{6k\Omega} = \frac{16V}{6k\Omega} = 2.667mW$$

## i1 VE KAYNAK TARAFINDAN SAĞLANAN GÜCÜ BULUN




Alternatif yaklaşım

$$\frac{1}{R_p}=\frac{1}{4k}+\frac{1}{20k}+\frac{1}{5k}=\frac{5+1+4}{20k}=\frac{1}{2k}\Rightarrow R_p=2k$$

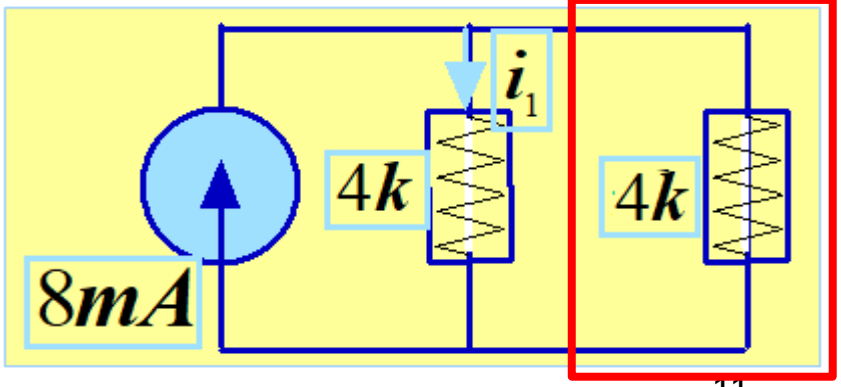
$$i_1=\frac{4k}{4k+4k}(8)=4mA$$

$$v=4k*i_1=16V$$

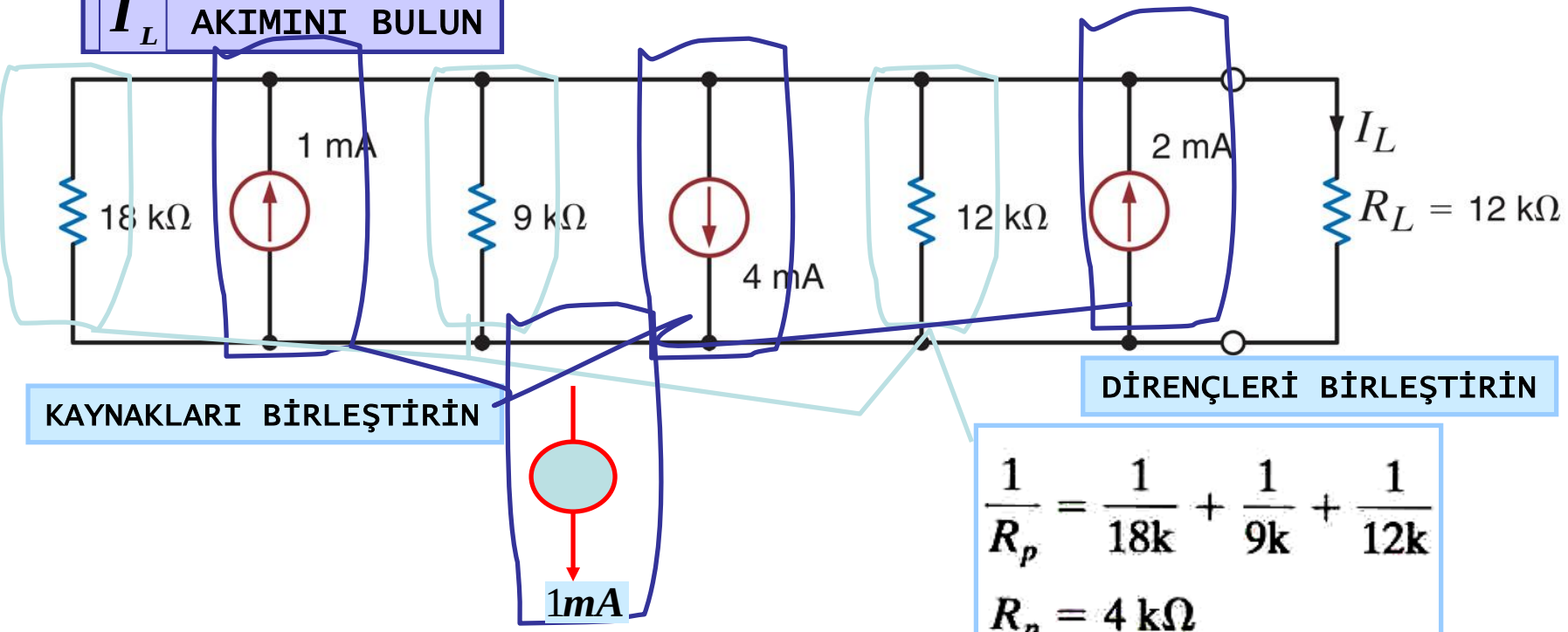
$$P=v(-8mA)=-128mW$$

$$\left.\begin{aligned} v(t)&=R_P i_o(t)\\ i_k(t)&=\frac{v(t)}{R_k}\end{aligned}\right\}\Rightarrow i_K(t)=\frac{R_p}{R_k}i_o(t)$$

Genel akım bölücü



**$I_L$ AKIMINI BULUN**

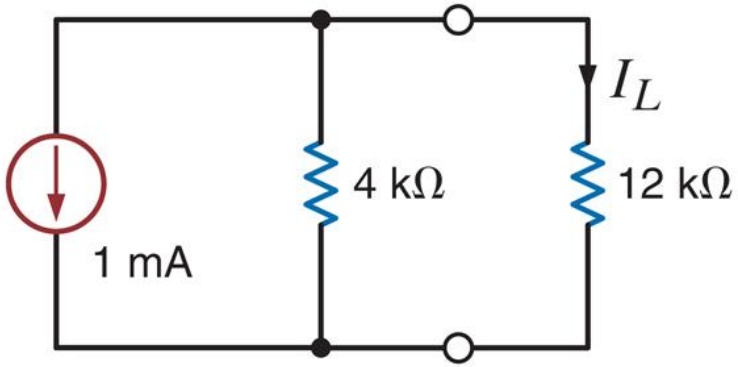



KAYNAKLARI BİRLEŞTİRİN

DİRENÇLERİ BİRLEŞTİRİN

$$\frac{1}{R_p} = \frac{1}{18\text{k}} + \frac{1}{9\text{k}} + \frac{1}{12\text{k}}$$

$$R_p = 4\ \text{k}\Omega$$

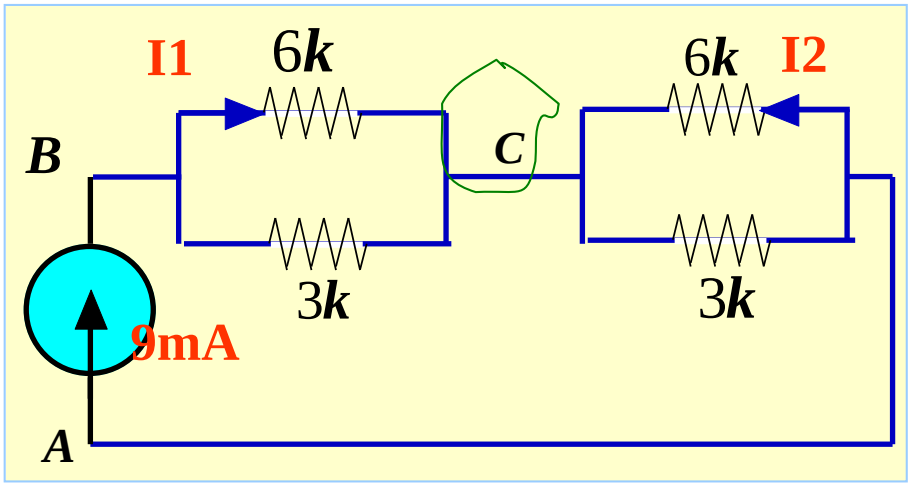



STRATEJİ: KAYNAKLARI VE DİRENÇLERİ BİRLEŞTİREREK PROBLEMİ TEMEL AKIM BÖLÜCÜ DURUMUNA GETİRİN.
SONRAKİ BÖLÜMDE DAHA DETAYLI DİRENÇ BİRLEŞTİRME İŞLEMLERİ YAPILACAK.

$$I_L = -\left[\frac{4\text{k}}{4\text{k} + 12\text{k}}\right](1 \times 10^{-3})$$

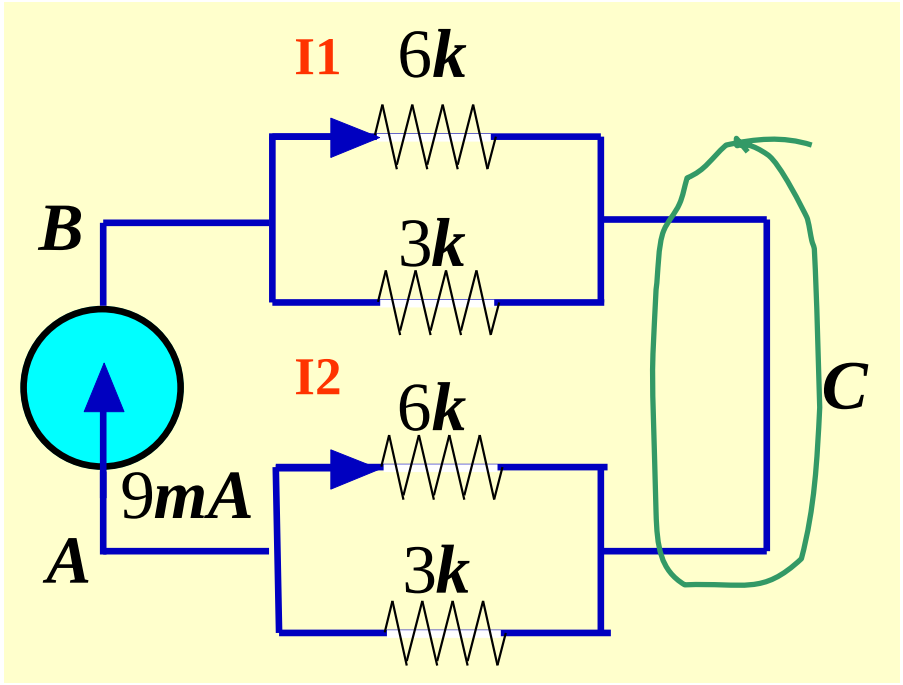
$$= -0.25\ \text{mA}$$

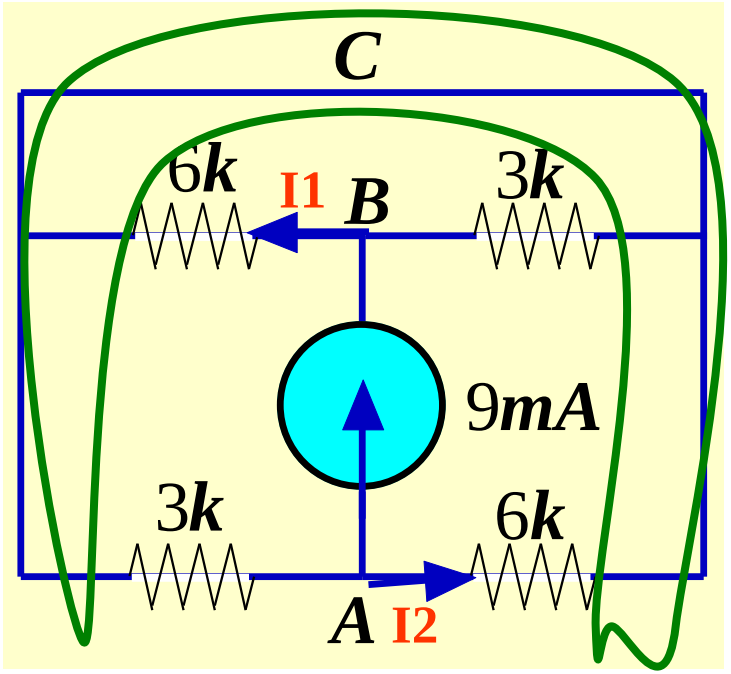
EKSİ İŞARETİNE DİKKAT EDİN



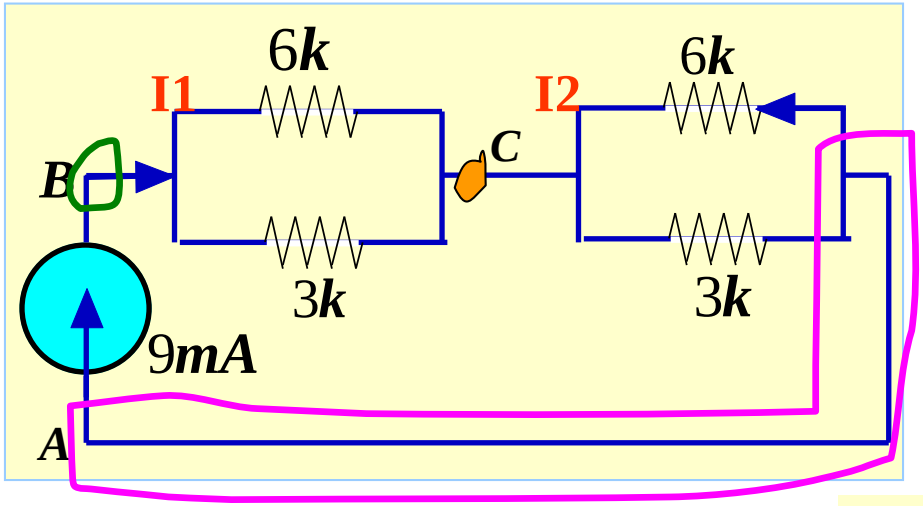

$$I_1 = \frac{3}{9} 9[mA] = 3mA$$

$$I_2 = -I_1$$

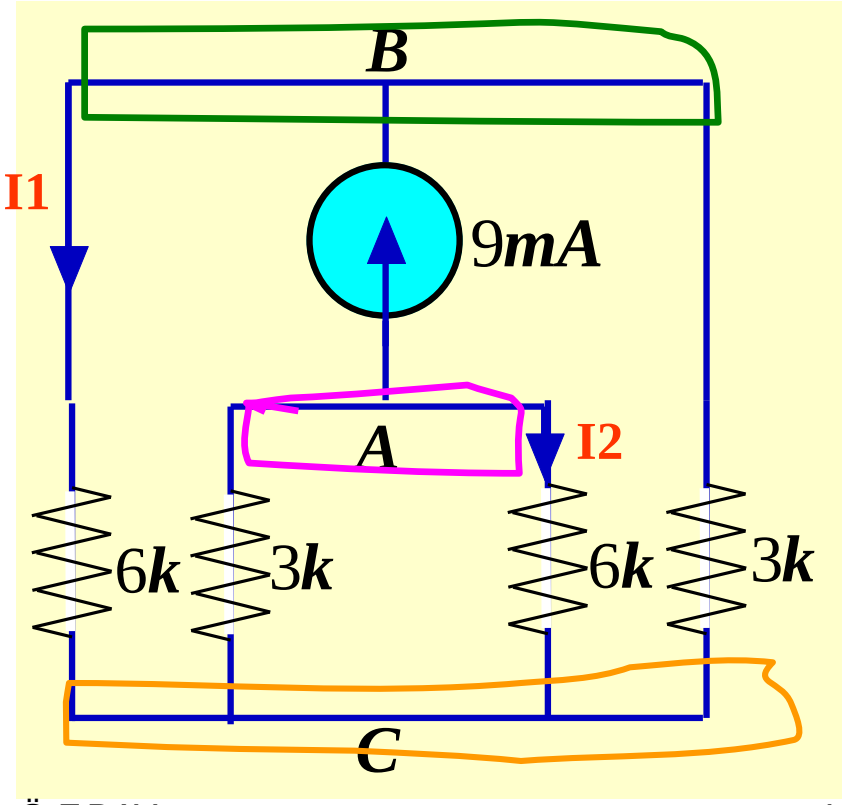


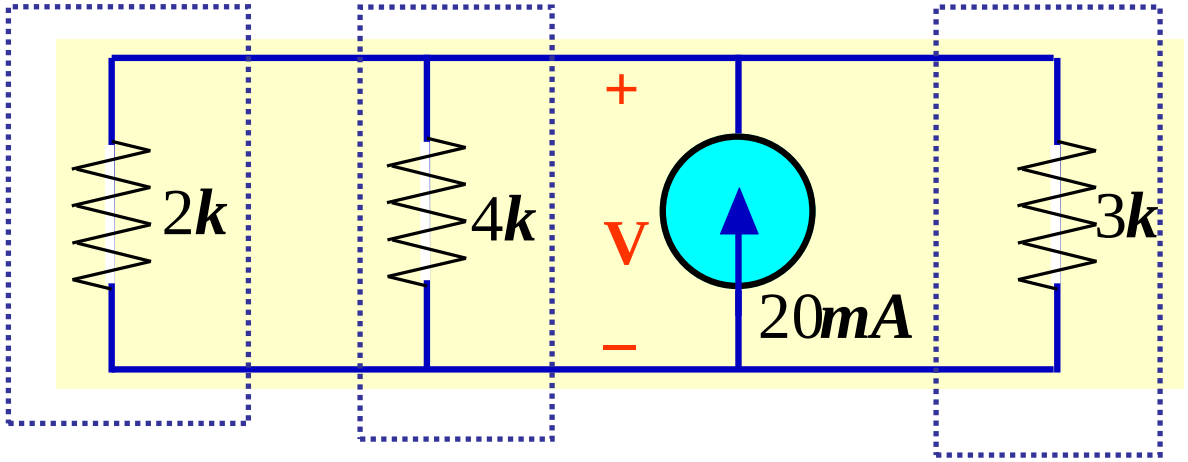




**AYNI ELEKTRİK DEVRESİNE FARKLI BAKIŞ**




Bir devrenin yeniden çizilmesi bazen elektrik bağlantılarını daha iyi görselleştirmeye yardımcı olabilir






**Kaynak tarafından sağlanan gücü belirleyin**

$$P = Rp * (20mA)^2$$

$$\frac{1}{Rp} = \frac{1}{2k} + \frac{1}{4k} + \frac{1}{3k} = \frac{6+3+4}{12k}$$

$$Rp = \frac{12}{13}k$$

$$\boldsymbol{P} = \frac{12}{13} * 10^3 \Omega * (20 * 10^{-3})^2 [\boldsymbol{A}]$$

$$\boldsymbol{P} = \frac{4.800}{13} \boldsymbol{W}$$