# FİZ-207
# TEKNİK ELEKTRİK

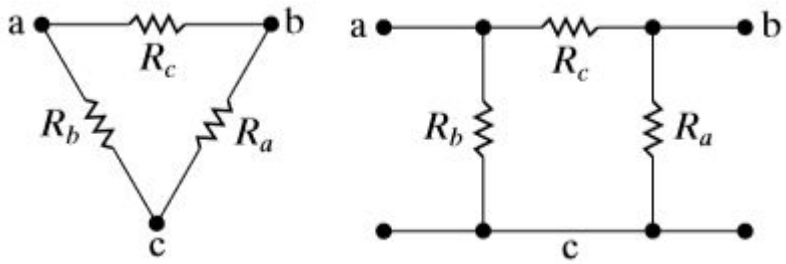
Ankara Üniversitesi

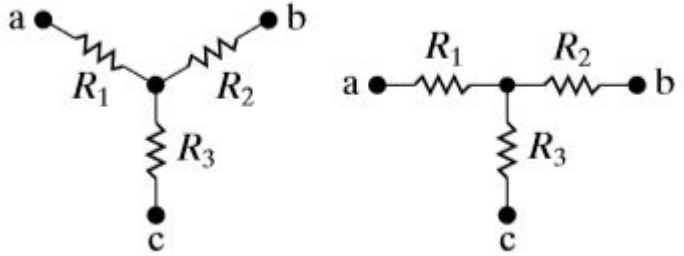
Fen Fakültesi

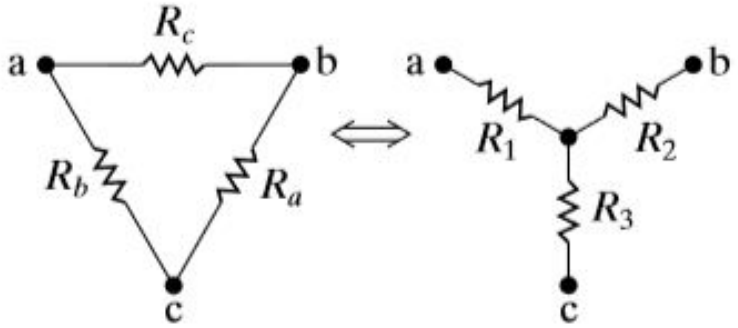
Fizik Bölümü

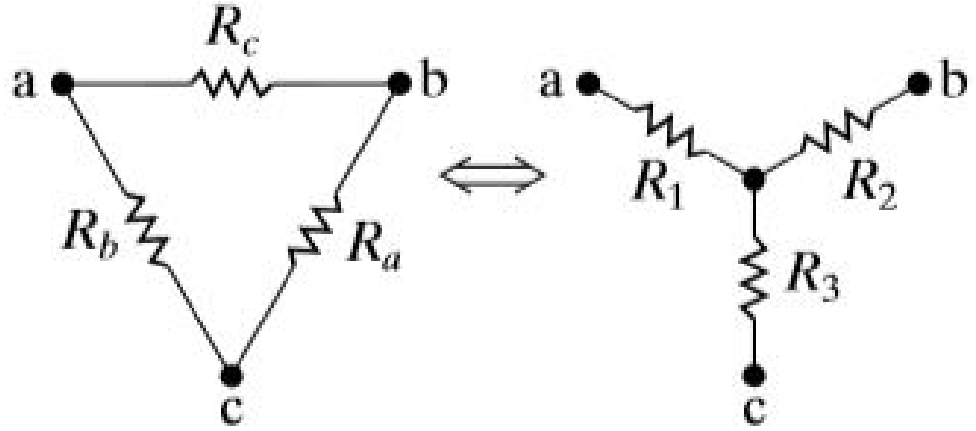
# Delta-Y Eşdeğer Devreleri

Yalnız seri-paralel birleştirmelerle çözümlenemeyen devreler de vardır. Bunlar, çoğu kez bir Y-Δ dönüşümünün kullanılması ile çözümlenebilir. Bu dönüşüm, bir Y şekli oluşturan üç direncin, bir Δ şekli oluşturan üç dirençle yer değiştirmesine, ya da tersine izin verir.






$$R_{ab} = \frac{R_c(R_a + R_b)}{R_a + R_b + R_c} = R_1 + R_2,$$

$$R_{bc} = \frac{R_a(R_b + R_c)}{R_a + R_b + R_c} = R_2 + R_3,$$

$$R_{ca} = \frac{R_b(R_c + R_a)}{R_a + R_b + R_c} = R_1 + R_3.$$

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

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

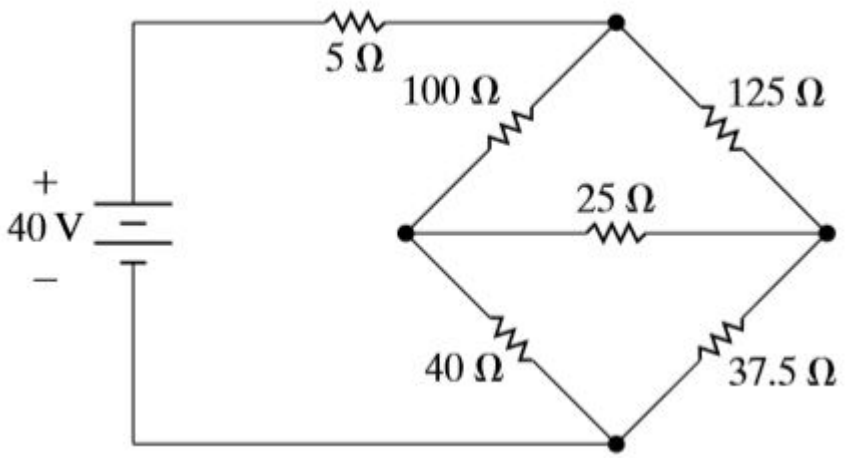
$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}.$$

$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1},$$

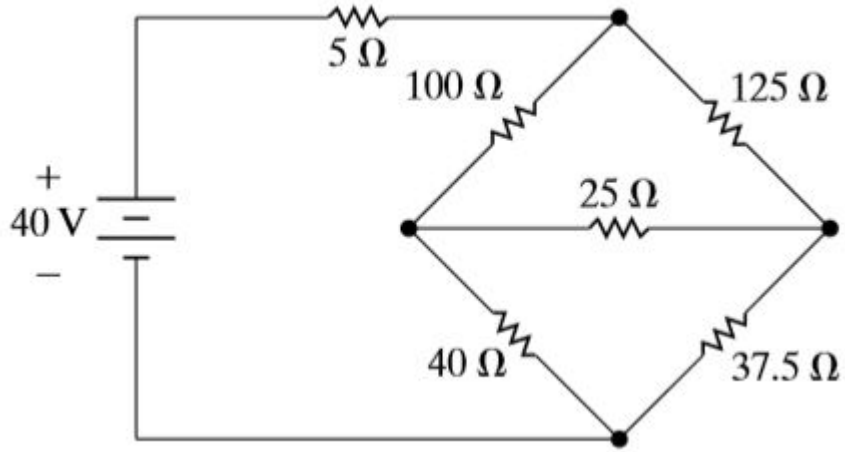
$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2},$$

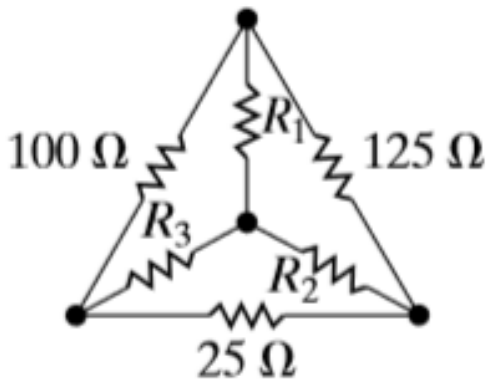
$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3}.$$

# Örnek:




Şekildeki devrede 40 V kaynak tarafından verilen akım ve gücü bulunuz.



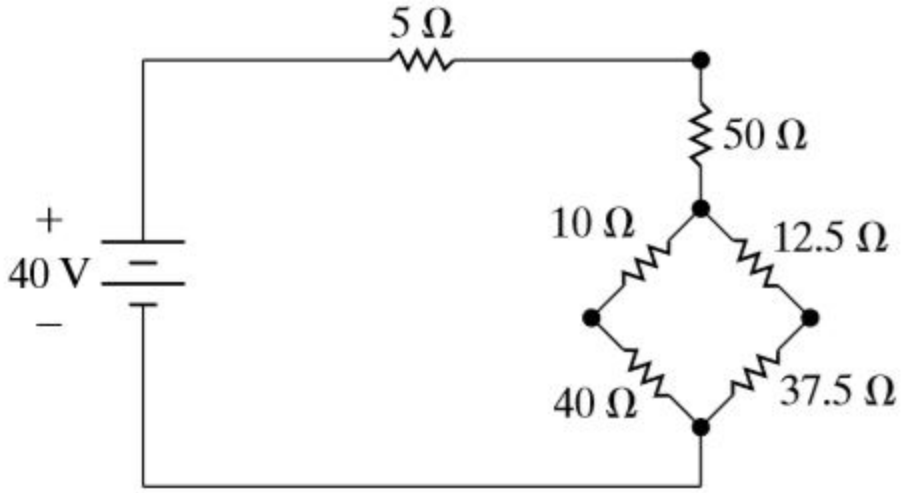



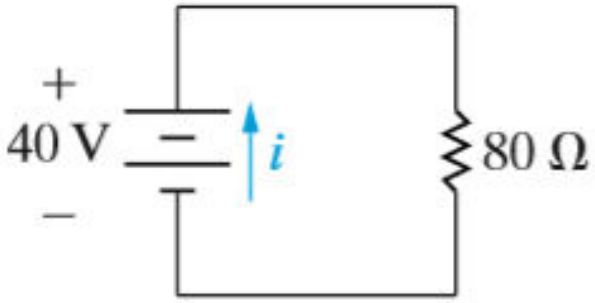

$$R_1 = \frac{100 \times 125}{250} = 50\ \Omega,$$

$$R_2 = \frac{125 \times 25}{250} = 12.5\ \Omega,$$

$$R_3 = \frac{100 \times 25}{250} = 10\ \Omega.$$

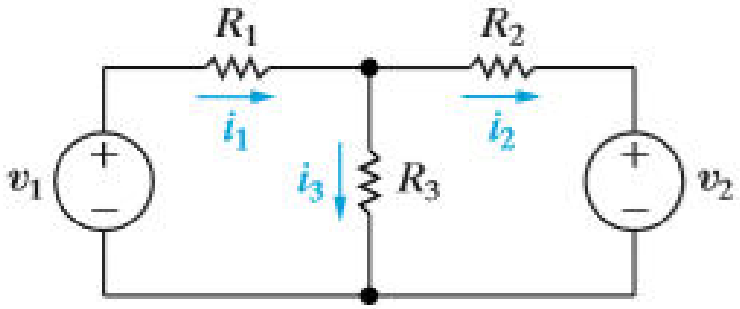
$$R_{\text{eq}} = 55 + \frac{(50)(50)}{100} = 80\ \Omega.$$




- 40 V kaynak devreye 0,5 A ve 20 W verir.

# İLMEK AKIMI YÖNTEMİ



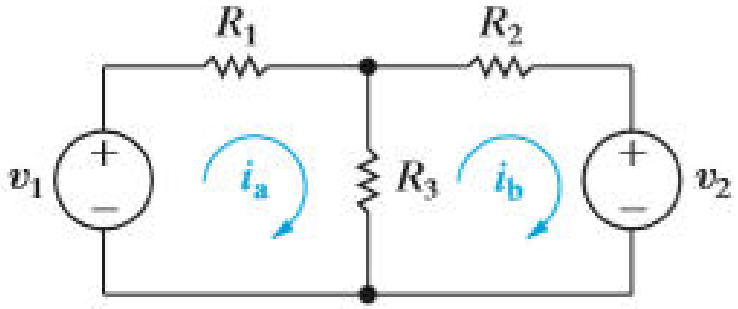

$$i_1 = i_2 + i_3,$$

$$v_1 = i_1R_1 + i_3R_3,$$

$$-v_2 = i_2R_2 - i_3R_3.$$

$$v_1 = i_1(R_1 + R_3) - i_2R_3,$$

$$-v_2 = -i_1R_3 + i_2(R_2 + R_3).$$

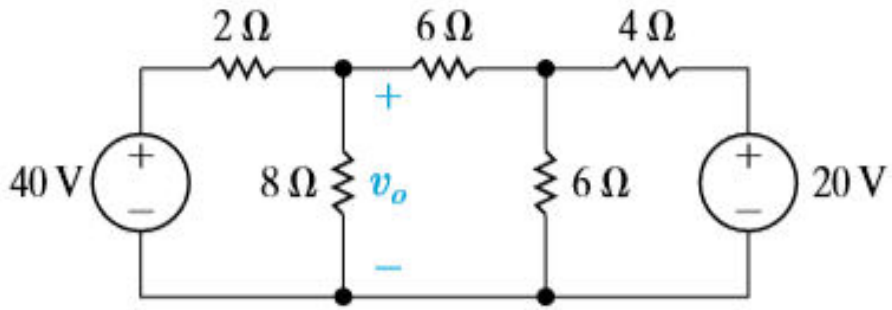



$$v_1 = i_a R_1 + (i_a - i_b) R_3,$$
$$-v_2 = (i_b - i_a) R_3 + i_b R_2.$$

$$v_1 = i_a(R_1 + R_3) - i_b R_3,$$
$$-v_2 = -i_a R_3 + i_b(R_2 + R_3).$$

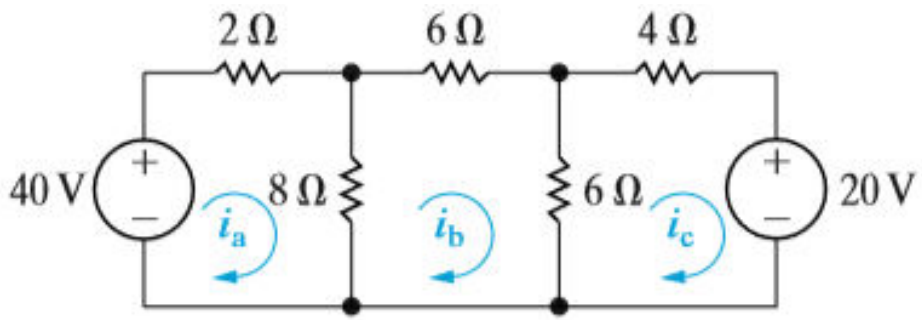
$$i_1 = i_a,$$
$$i_2 = i_b,$$
$$i_3 = i_a - i_b.$$

# Örnek




a) Şekildeki devrede her gerilim kaynağı ile ilgili gücü ilmek akımı yöntemini kullanarak bulunuz.

b) 8 Ω üzerindeki gerilimi hesaplayınız.




$$-40 + 2i_a + 8(i_a - i_b) = 0,$$

$$8(i_b - i_a) + 6i_b + 6(i_b - i_c) = 0,$$

$$6(i_c - i_b) + 4i_c + 20 = 0.$$

$$10i_a - 8i_b + 0i_c = 40;$$

$$-8i_a + 20i_b - 6i_c = 0;$$

$$0i_a - 6i_b + 10i_c = -20.$$

$$i_a = 5.6 \text{ A}, \qquad p_{20\text{V}} = 20i_c = -16 \text{ W}.$$

$$i_b = 2.0 \text{ A}, \qquad p_{40\text{V}} = -40i_a = -224 \text{ W}.$$

$$i_c = -0.80 \text{ A}.$$

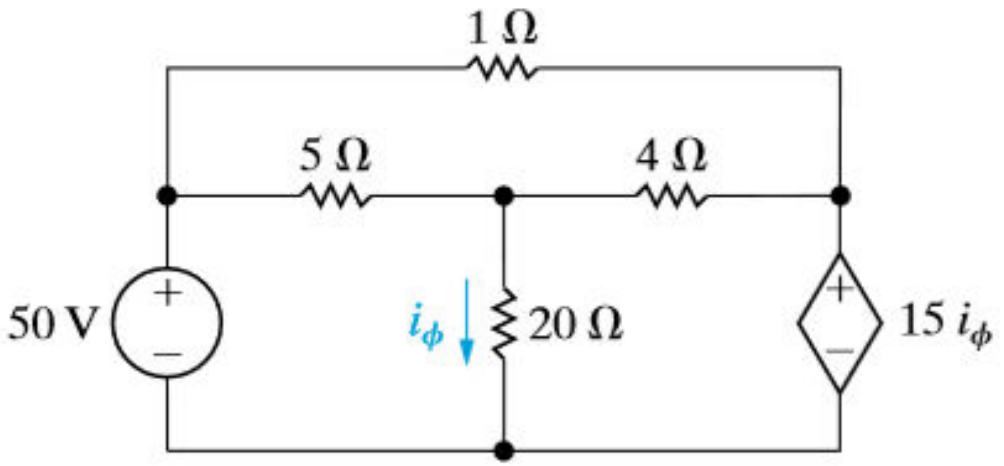
b) $v_o = 8(i_a - i_b) = 8(3.6) = 28.8 \text{ V}.$

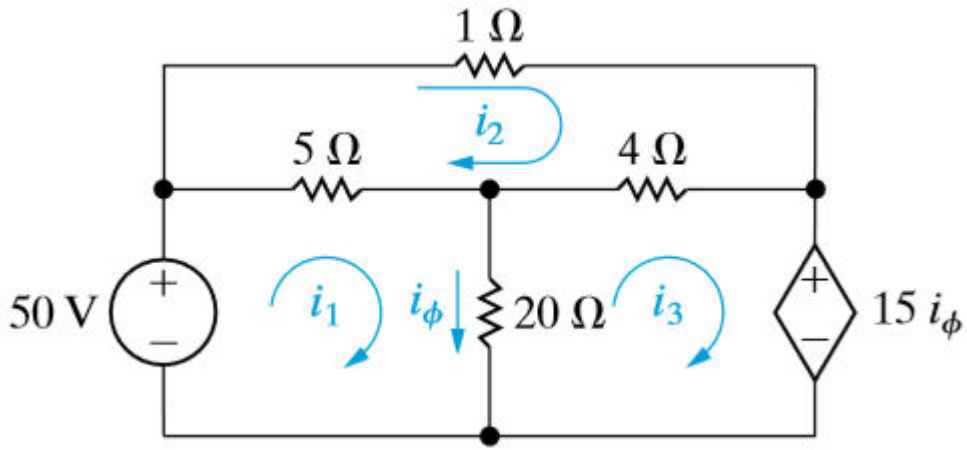
# Bağımlı Kaynaklı Devrelerde Düğüm-Noktası ve İlmek Yöntemleri

Eğer devrede bağımlı kaynak var ise, bu kaynaklar tarafından oluşturulan kısıt denklemleri de eklenerek düğüm gerilimi veya ilmek akımı denklemleri yazılmalıdır.

# Örnek:

Şekildeki devrede 4 ohm'luk direnç üzerinde harcanan gücü ilmek akımı yöntemini kullanarak çözünüz.






$$50 = 5(i_1 - i_2) + 20(i_1 - i_3),$$

$$0 = 5(i_2 - i_1) + 1i_2 + 4(i_2 - i_3),$$

$$0 = 20(i_3 - i_1) + 4(i_3 - i_2) + 15i_\phi. \quad (4.34)$$

$$i_\phi = i_1 - i_3,$$

$$50 = 25i_1 - 5i_2 - 20i_3,$$

$$0 = -5i_1 + 10i_2 - 4i_3,$$

$$0 = -5i_1 - 4i_2 + 9i_3.$$

$$i_2 = 26 \text{ A},$$

$$i_3 = 28 \text{ A}.$$

$$p_{4\Omega} = (i_3 - i_2)^2(4) = (2)^2(4) = 16 \text{ W}.$$