Ηλεκτρικά Κυκλώματα Ι

Διάλεξη 15

Α. Δροσόπουλος

01-12-2022

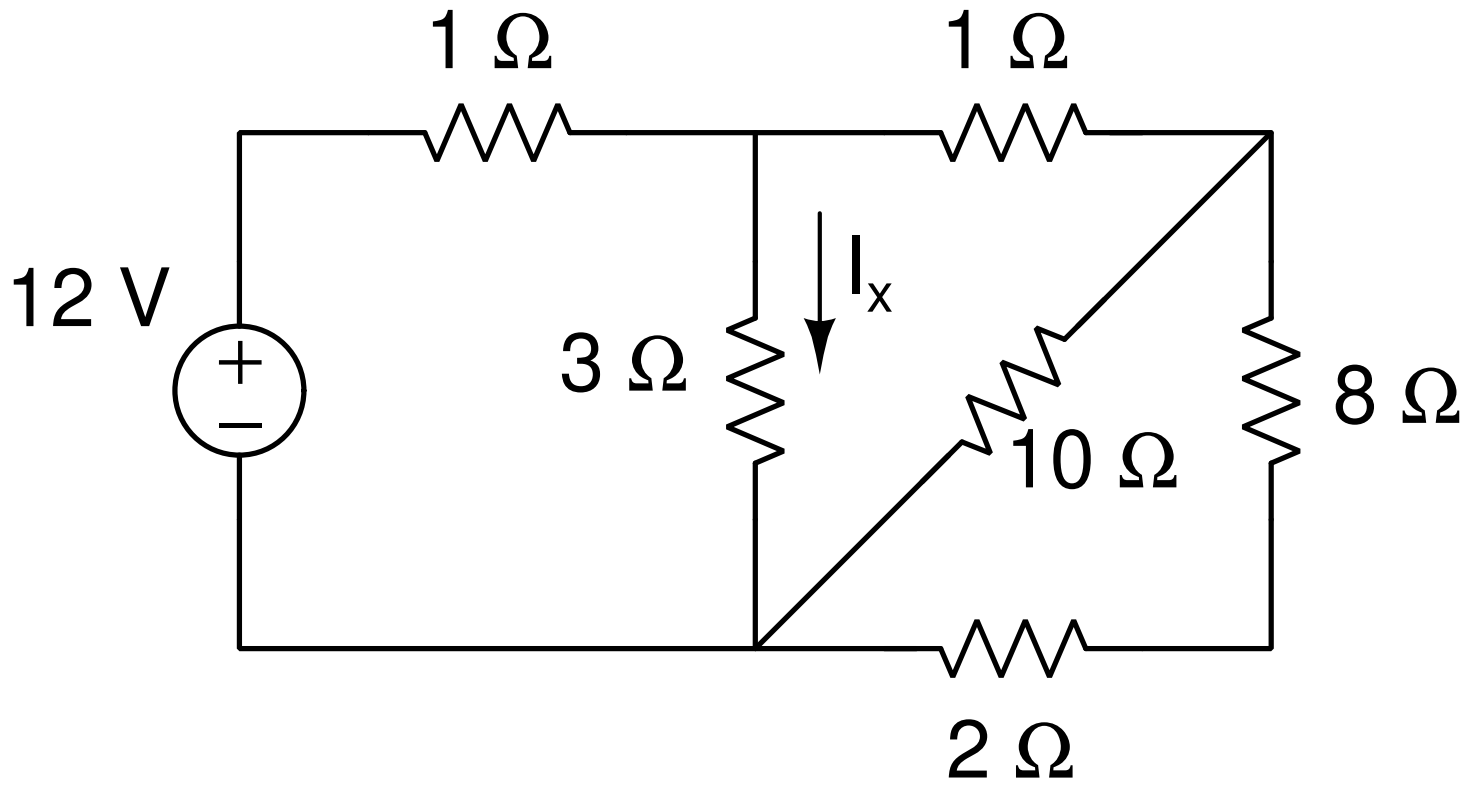
Outline

Topic

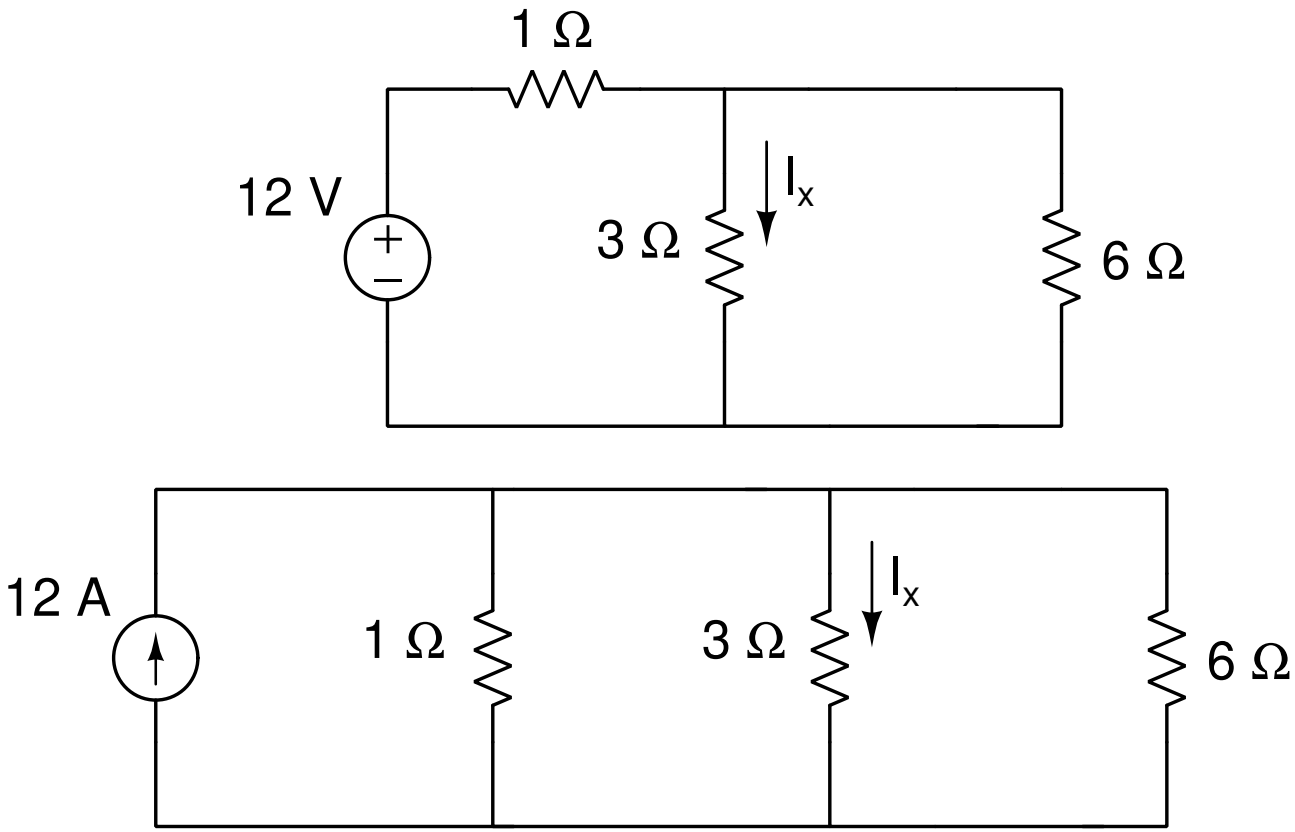
1. Ασκήσεις

Άσκηση 10

Να βρεθεί το I_x.



10b

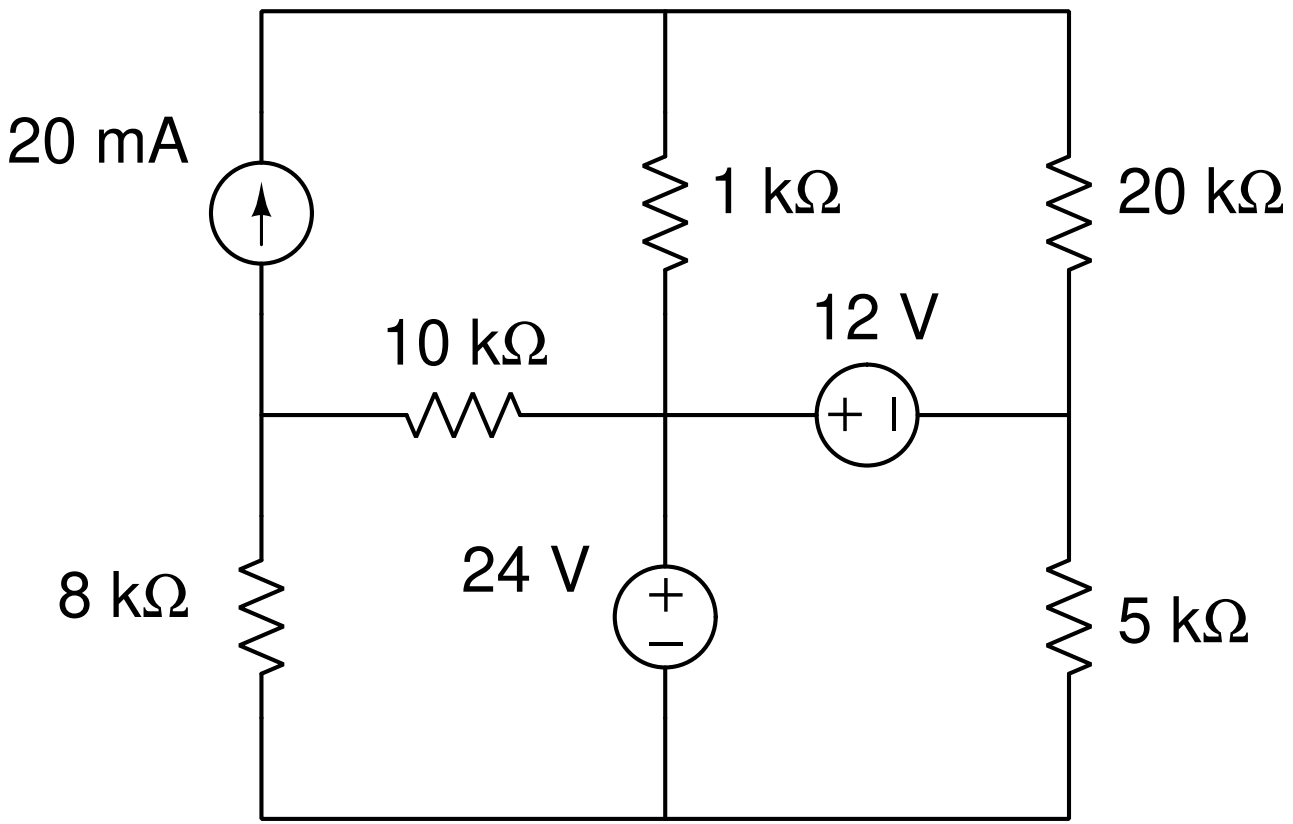


$$R = 1 \parallel 3 \parallel 6 = 0.667\ \Omega$$

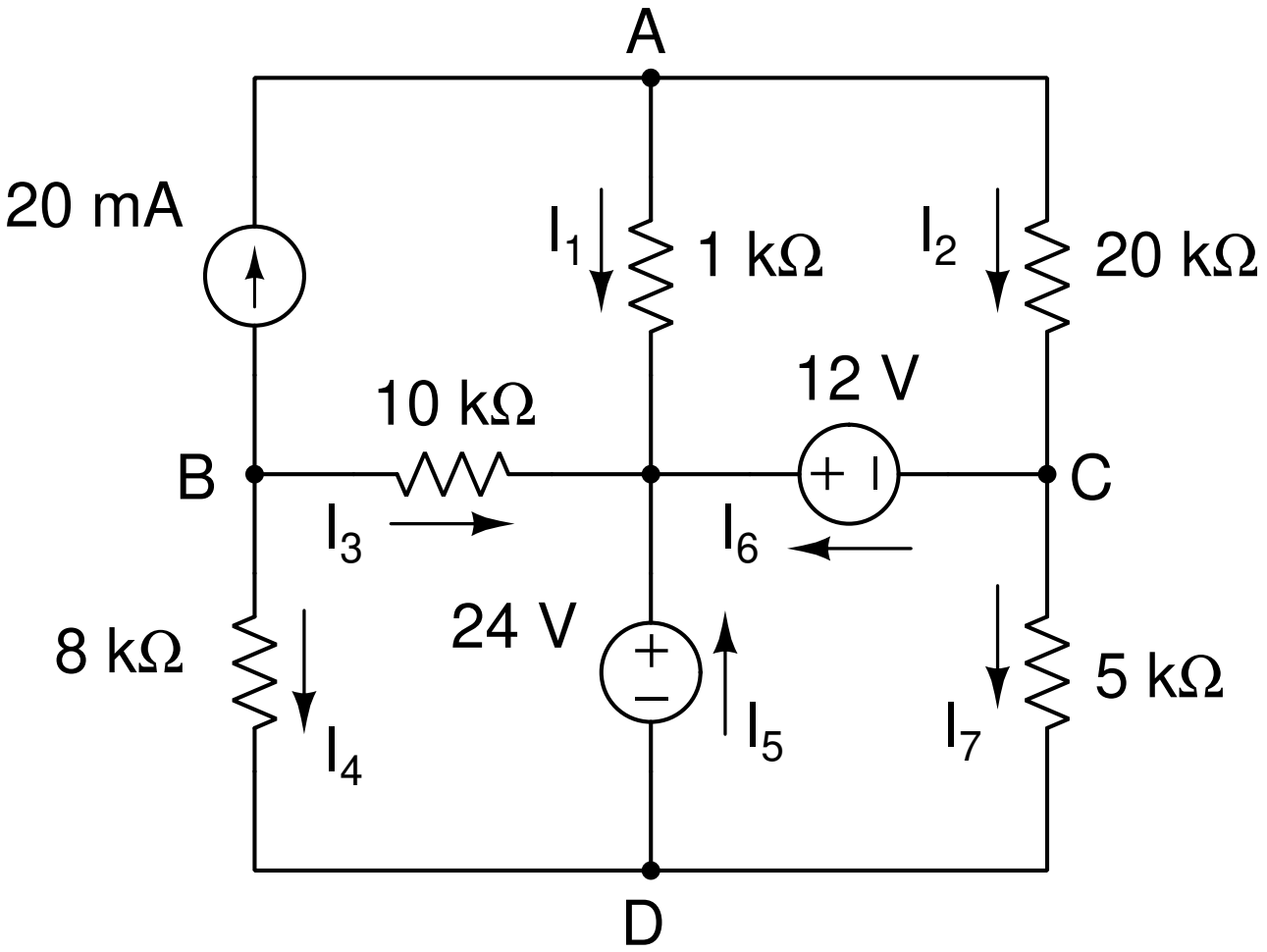
$$V = 12R = 8\ \text{V} \qquad I_x = \frac{V}{3} = 2.667\ \text{A}$$

Άσκηση 11

Να βρεθεί η ισχύς που καταναλώνεται στην $5\ \text{k}\Omega$.



11b - Kirchhoff κλαδικά ρεύματα



11c

A: $20 - I_1 - I_2 = 0$
B: $-20 - I_3 - I_4 = 0$
C: $I_2 - I_6 - I_7 = 0$
D: $I_4 - I_5 + I_7 = 0$
$-I_1 + 20I_2 = 12$
$10I_3 - 8I_4 = -24$
$5I_7 = 24 - 12$

$$
\begin{aligned}
I_1 + I_2 &= 20 \\
I_3 + I_4 &= -20 \\
I_2 - I_6 - I_7 &= 0 \\
I_4 - I_5 + I_7 &= 0 \\
-I_1 + 20I_2 &= 12 \\
10I_3 - 8I_4 &= -24 \\
5I_7 &= 12
\end{aligned}
$$

11d

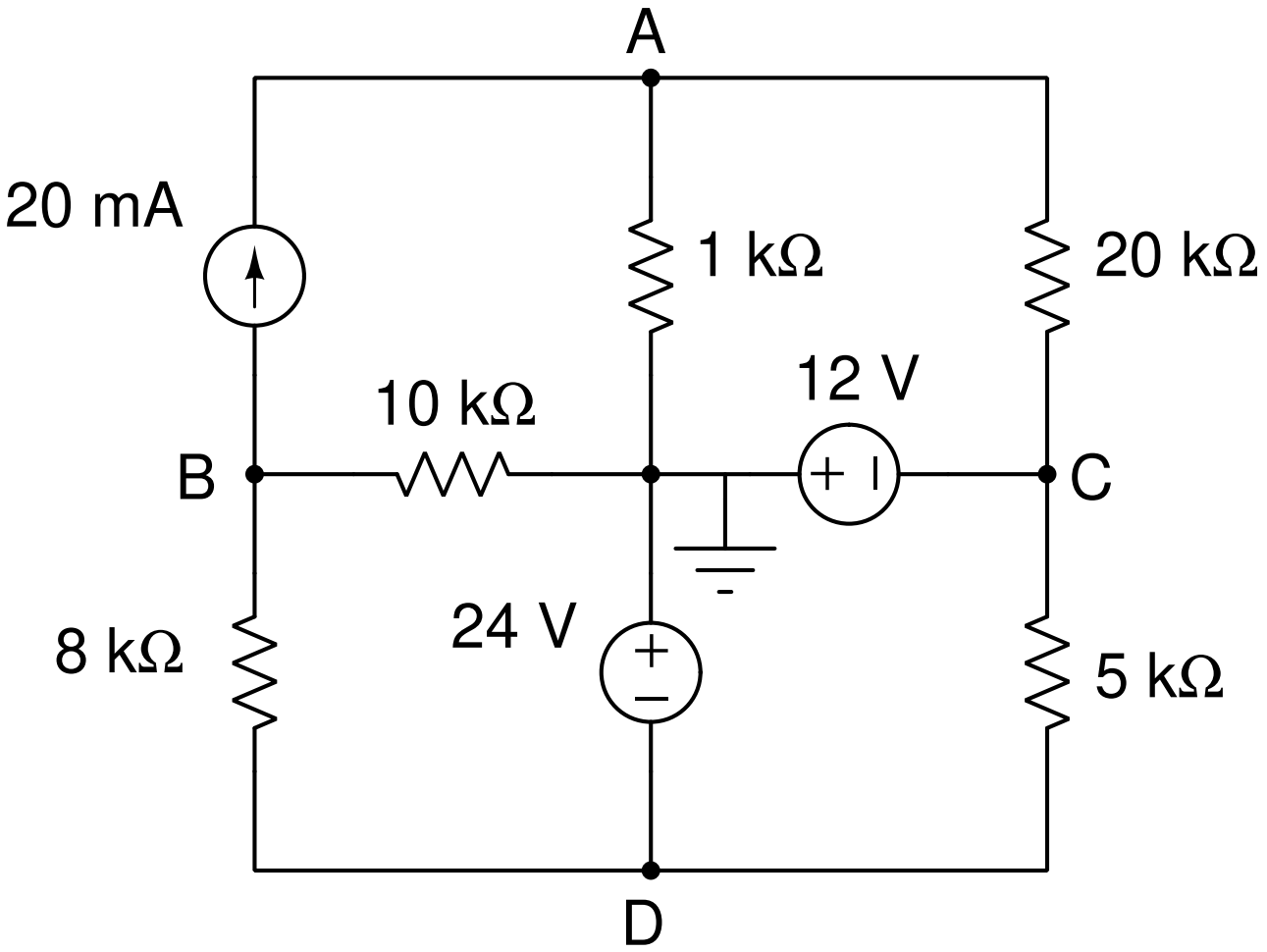
```
octave:5> A=[1 1 0 0 0 0 0; 0 0 1 1 0 0 0; 0 1 0 0 0 -1 -1; 0 0 0 1 -1 0 1;
-1 20 0 0 0 0 0; 0 0 10 -8 0 0 0; 0 0 0 0 0 0 5]
A =
    1    1    0    0    0    0    0
    0    0    1    1    0    0    0
    0    1    0    0    0   -1   -1
    0    0    0    1   -1    0    1
   -1   20    0    0    0    0    0
    0    0   10   -8    0    0    0
    0    0    0    0    0    0    5

octave:6> b=[20; -20; 0; 0; 12; -24; 12]
b =
   20
  -20
    0
    0
   12
  -24
   12
```

11e

```
octave:7> I=inv(A)*b
I =
   18.47619
    1.52381
  -10.22222
   -9.77778
   -7.37778
   -0.87619
    2.40000
octave:8> P=5*I(7)^2
P =  28.800
```

$$P_5 = 5I_7^2 = 28.8 \text{ mW}$$

11f - Kirchhoff κομβική ανάλυση



11g

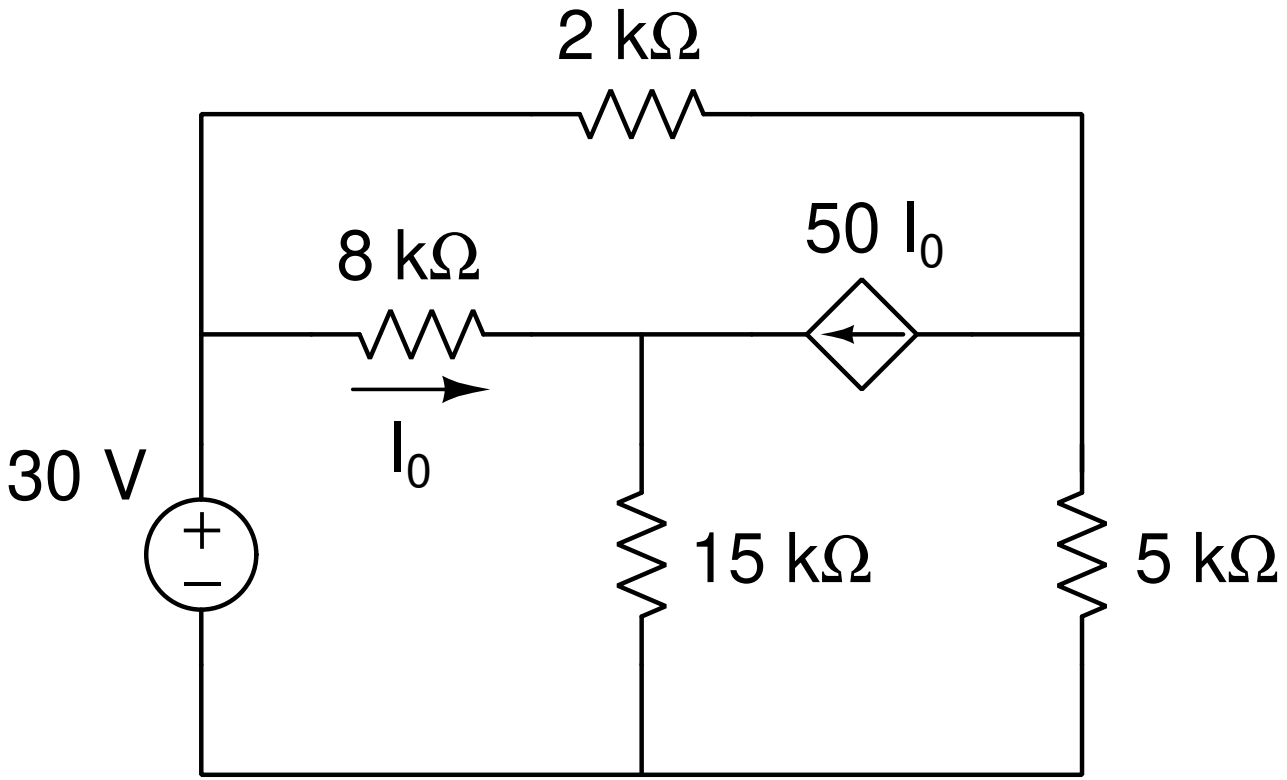
A: $-20 + V_A/1 + (V_A - V_C)/20 = 0$
B: $20 + V_B/10 + (V_B - V_D)/8 = 0$
C: $V_C = -12$
D: $V_D = -24$

$$V_{CD} = V_C - V_D = -12 + 24 = 12 \text{ V}$$

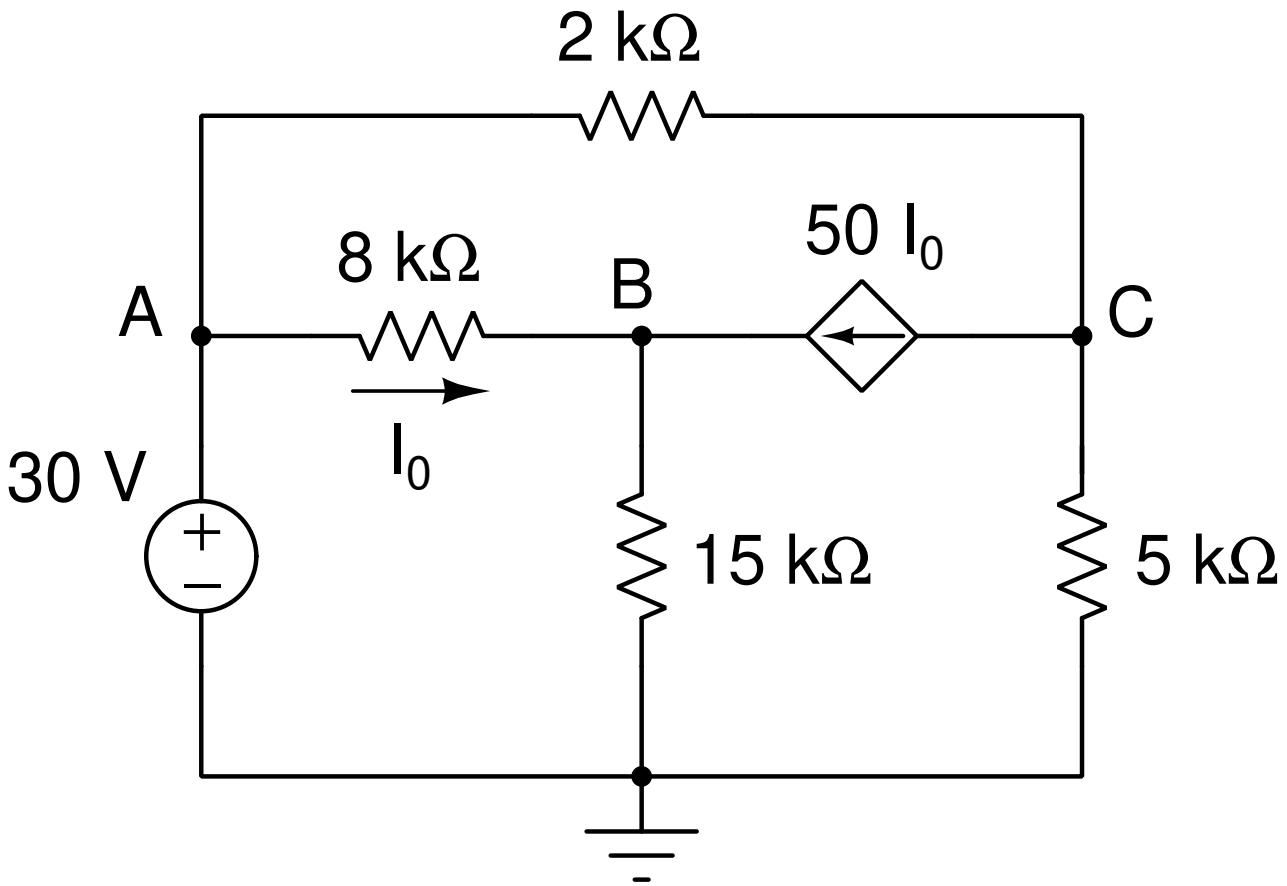
$$P_5 = V_{CD}^2/5 = 28.8 \text{ mW}$$

Άσκηση 12

Να βρεθεί η ισχύς που καταναλώνεται στην $5\ \text{k}\Omega$.



12b - Kirchhoff κομβική ανάλυση



12c

B: $$-I_0 - 50I_0 + \frac{V_B}{15} = 0$$

C: $$\frac{V_C - 30}{2} + 50I_0 + \frac{V_C}{5} = 0$$

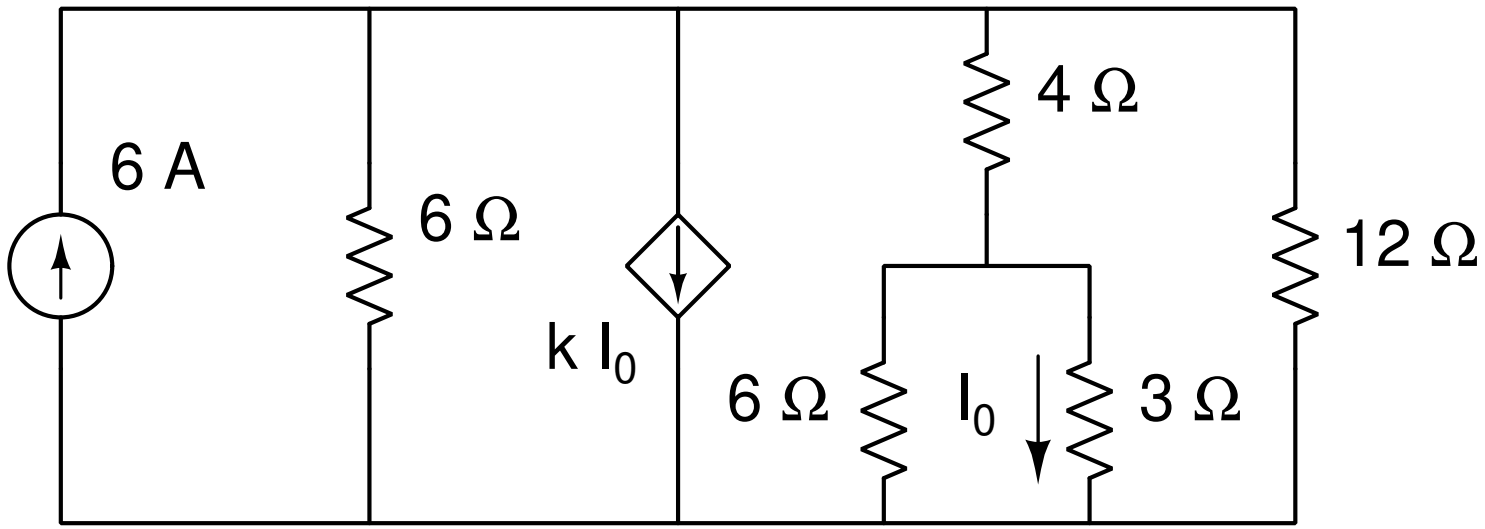
$$\frac{30 - V_B}{8} = I_0$$

```
octave:10> Vb=(51*30/8)/(51/8+1/15)
Vb =  29.690
octave:11> I0=(30-Vb)/8
I0 =  0.038810
octave:12> Vc=(15-50*I0)/(1/2+1/5)
Vc =  18.656
octave:13> P=Vc^2/5
P =  69.613
```

$$P = 69.6 \text{ mW}$$

Άσκηση 13

Να βρεθεί η τιμή της παραμέτρου k έτσι ώστε η ισχύς που δίνει η πηγή 6 A να είναι 108 W.



13b

Με κομβική ανάλυση

$$-6 + \frac{V}{6} + kI_0 + \frac{V}{6} + \frac{V}{12} = 0$$

$$V_3 = \frac{2}{4+2}\,V = \frac{V}{3}$$

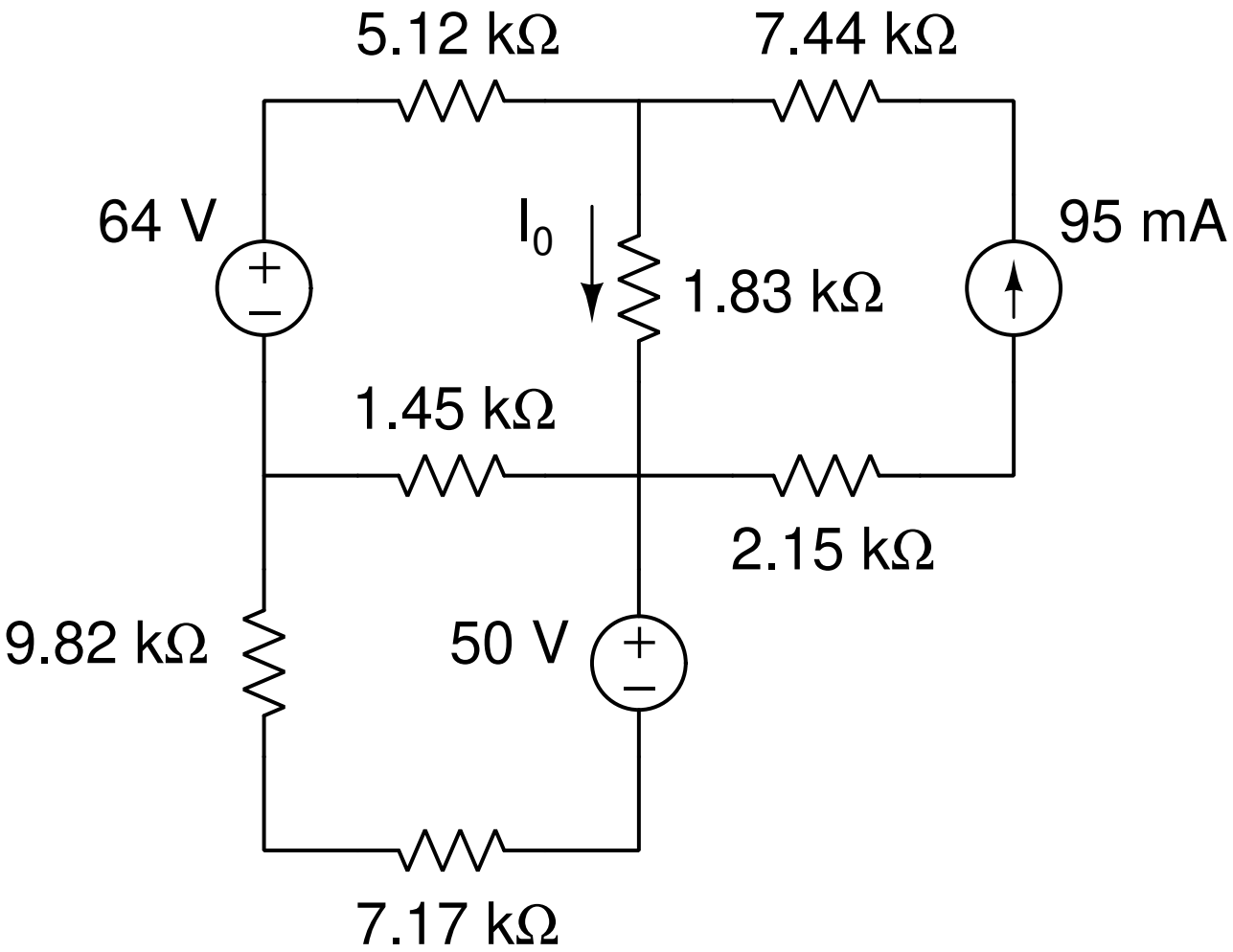
$$I_0 = \frac{V}{3 \cdot 3} = \frac{V}{9}$$

$$P = 6V = 108 \Rightarrow V = 18\ \text{V}$$

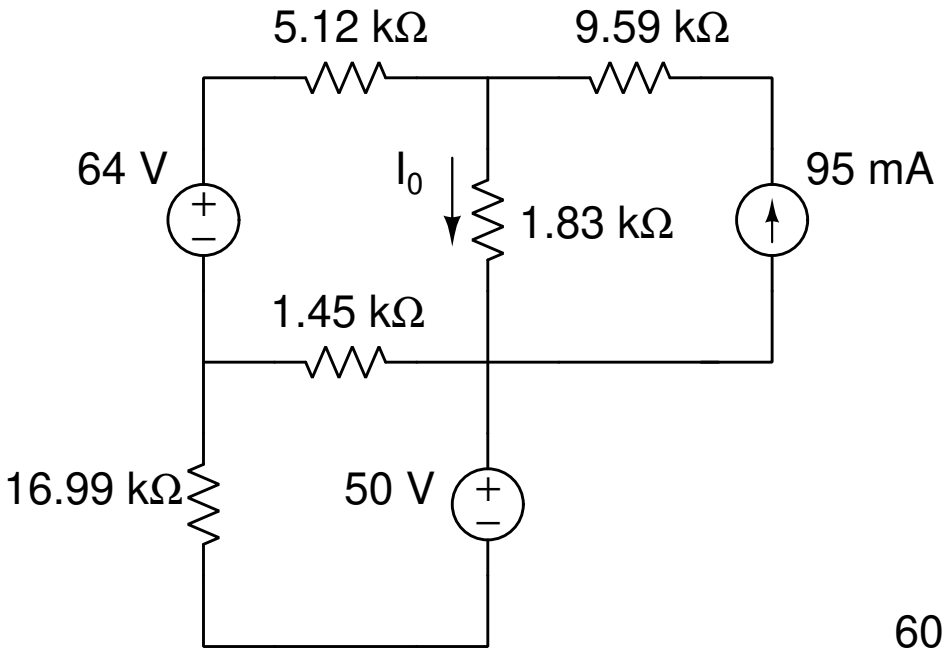
$$k = \frac{6 - V(1/6 + 1/6 + 1/12)}{V/9} = -0.75$$

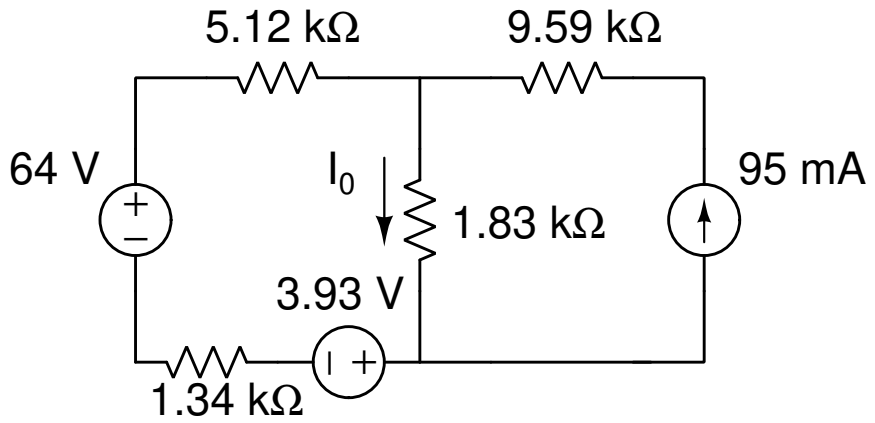
Άσκηση 14

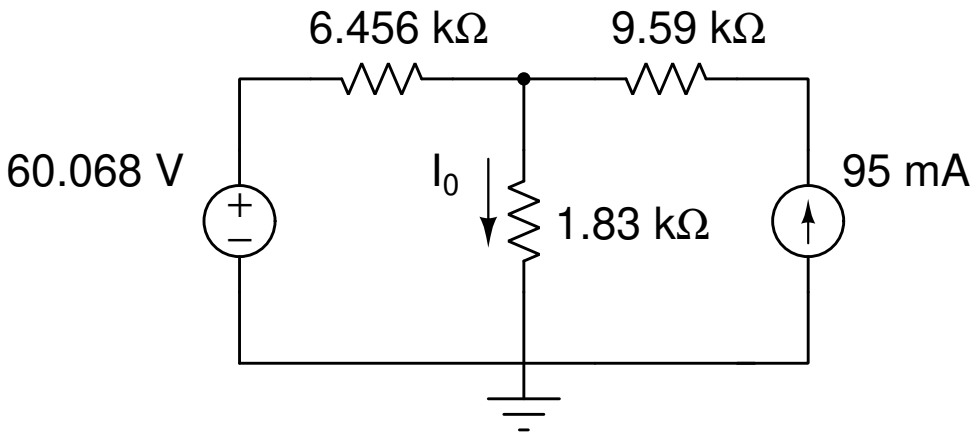
Να βρεθεί το I_0.



14b


5.12 kΩ
9.59 kΩ
64 V
I_0
1.83 kΩ
95 mA
1.45 kΩ
16.99 kΩ
50 V


5.12 kΩ
9.59 kΩ
64 V
I_0
1.83 kΩ
95 mA
3.93 V
1.34 kΩ


6.456 kΩ
9.59 kΩ
60.068 V
I_0
1.83 kΩ
95 mA

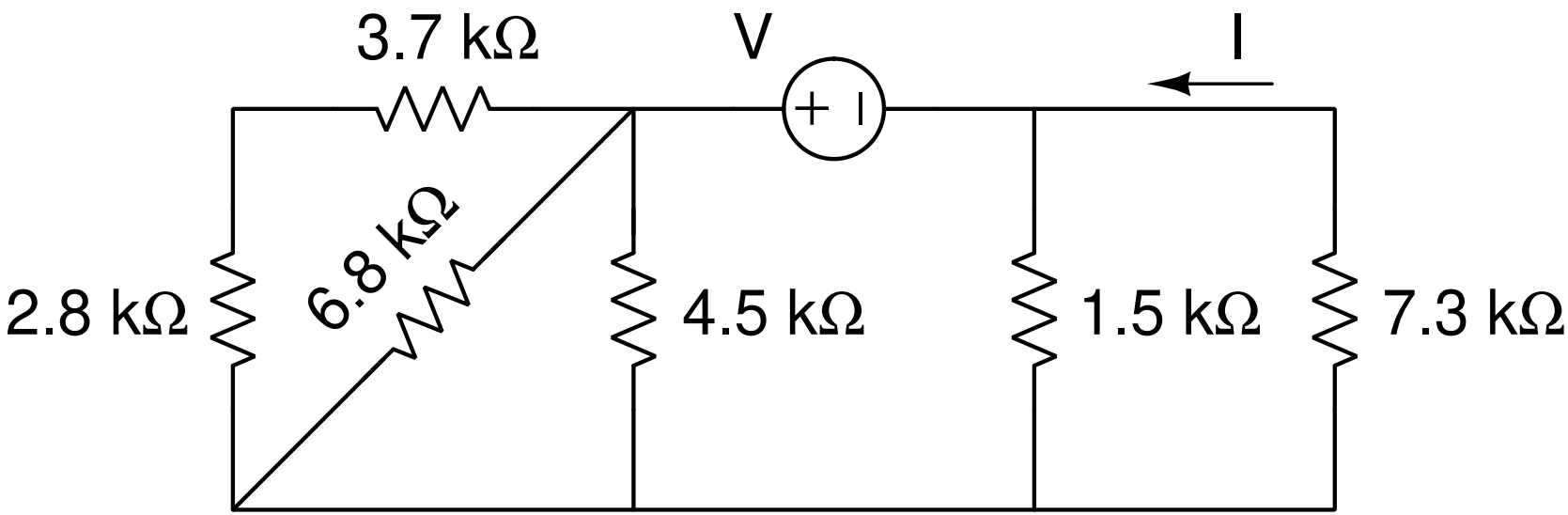
14c

```
octave:20> I1=50/16.99
I1 =  2.9429
octave:21> r1=16.99*1.45/(16.99+1.45)
r1 =  1.3360
octave:22> V1=I1*r1
V1 =  3.9317
octave:23> r2=5.12+r1
r2 =  6.4560
octave:24> V2=64-V1
V2 =  60.068
octave:25> V = (95+V2/r2)/(1/r2+1/1.83)
V =  148.72
octave:26> I0=V/1.83
I0 =  81.268
```

$$I_0 = 81.3 \text{ mA}$$

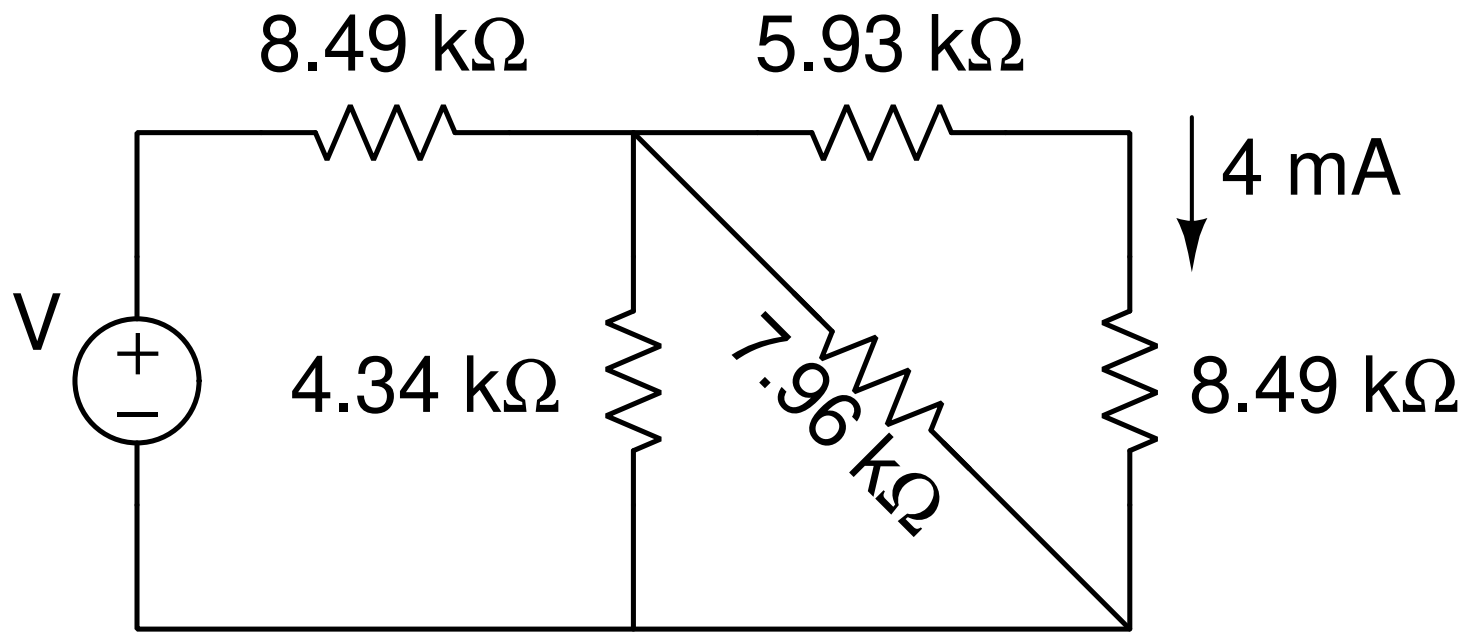
Άσκηση 4.7

Εάν $I = 8$ mA να βρεθεί η τάση V στο κύκλωμα.



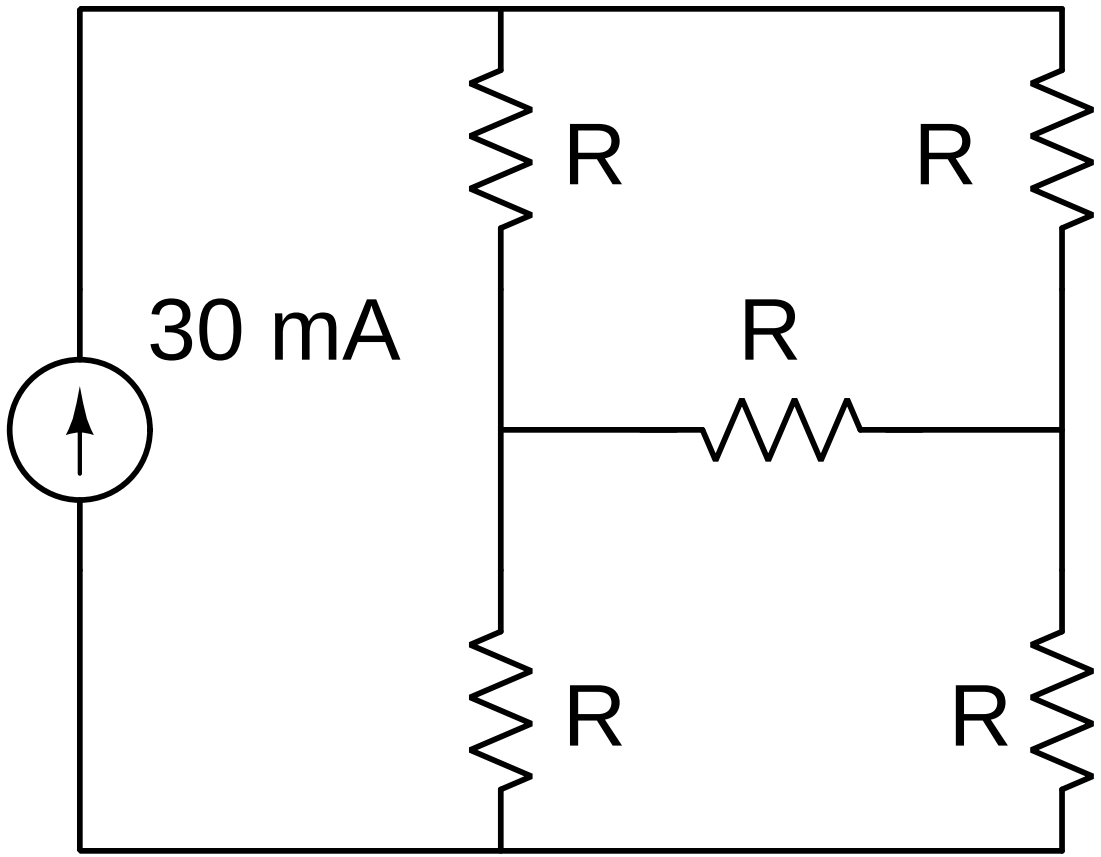
Άσκηση 4.8

Να υπολογιστεί η τάση V στο κύκλωμα.

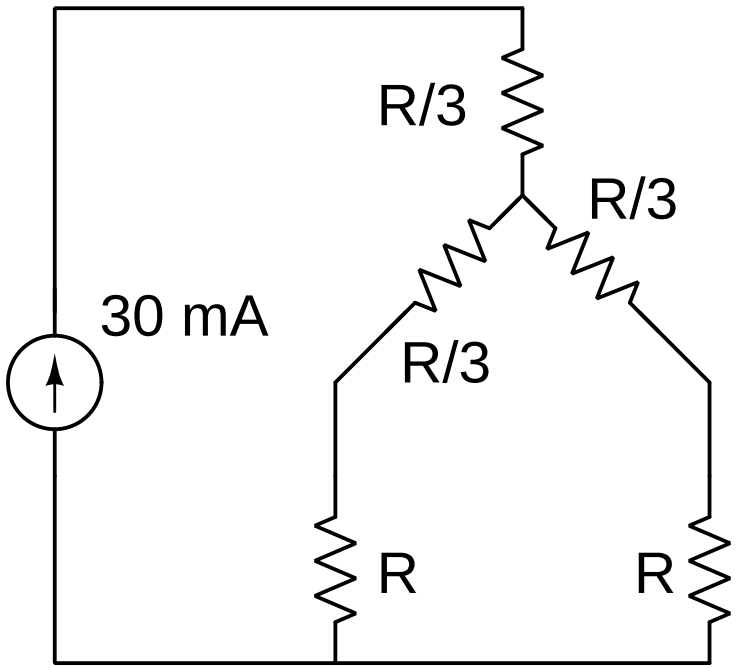


Άσκηση 2

Για ποια τιμή R θα δώσει η πηγή ρεύματος ισχύ $800\ \mathrm{mW}$;



Άσκηση 2b

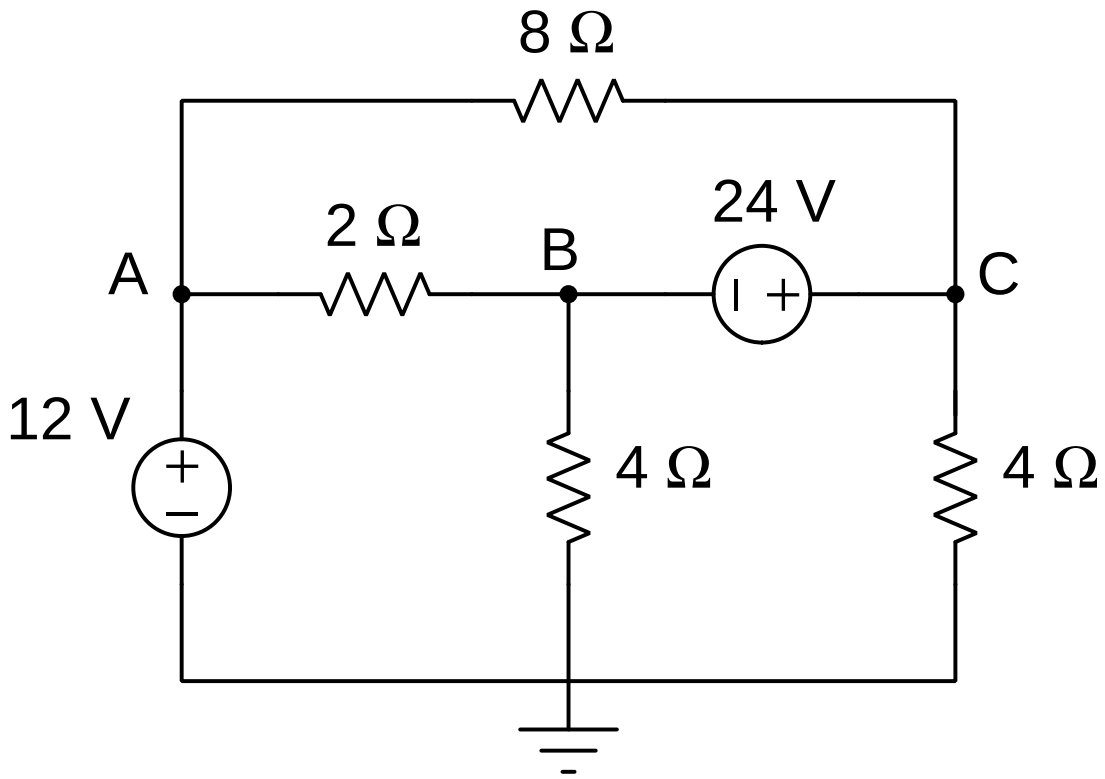


$$\frac{4}{3}R \parallel \frac{4}{3}R = \frac{2}{3}R \quad \text{και} \quad \frac{2}{3}R + \frac{1}{3}R = R$$

```
octave:7> P=800e-3; I=30e-3; R=P/I^2
R =  888.89
```

Άσκηση 3

Ποιες είναι οι τάσεις μεταξύ A, B, C και γής;



Άσκηση 3b

Με μέθοδο κόμβων (προσθέτουμε ρεύμα I_x μεταξύ B και C)

$$\left.\begin{aligned} \frac{V_B - 12}{2} + \frac{V_B}{4} + I_x &= 0 \\ \frac{V_C - 12}{8} + \frac{V_C}{4} - I_x &= 0 \\ V_C - V_B &= 24 \end{aligned}\right\} \Rightarrow \begin{aligned} V_B\left(\frac{1}{2} + \frac{1}{4}\right) + V_C\left(\frac{1}{8} + \frac{1}{4}\right) &= \left(\frac{12}{2} + \frac{12}{8}\right) \\ -V_B + V_C &= 24 \end{aligned}$$

Άσκηση 3c

```
octave:8> A=[1/2+1/4 1/8+1/4;-1 1]
A =
   0.75000   0.37500
  -1.00000   1.00000

octave:9> b=[12/2+12/8; 24]
b =
    7.5000
   24.0000

octave:10> V=inv(A)*b
V =
   -1.3333
   22.6667
```

Άρα, $V_A = 12\ \mathrm{V}$, $V_B = -1.33\ \mathrm{V}$, $V_C = 22.7\ \mathrm{V}$.