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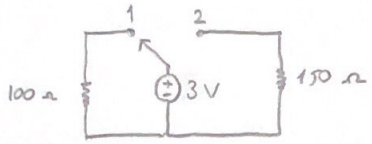
# CSE 231 - Homework 1

## 1. Question 2.4

(a) Calculate current $i$ in Figure when the switch is in position 1.

(b) Find the current when the switch is in position 2.



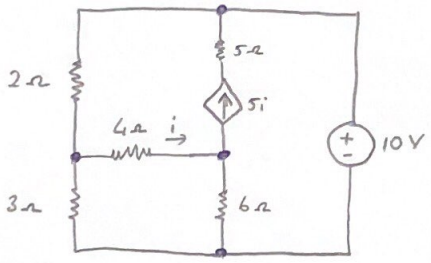

Solution:

a) $V = I.R$ then, $3V = I.100\,\Omega \Rightarrow I = 0.03\ A$

b) $3V = I.150\,\Omega \Rightarrow I = 0.02\ A$

## 2. Question 2.7

Determine the number of branches and nodes in the circuit in Figure.




Solution:

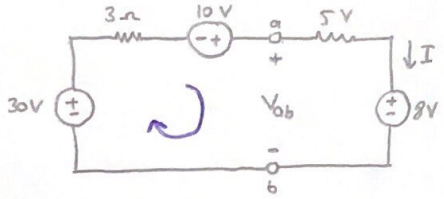
There are 4 nodes. The nodes are colored blue above.

The circuit above has 7 element. Thus, it has seven branches.

- 2 Ω resistor
- 3 Ω resistor
- 4 Ω resistor
- 5 Ω resistor
- 6 Ω resistor
- 5i current source
- 10 V voltage source

## 3. Question 2.15

Find $I$ and $V_{ab}$ in the circuit of figure.




Solution:

The cycle is colored blue above. Then equation

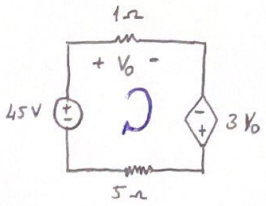
$$-30\,V + 3I - 10V + 5.I + 8V = 0$$

$$8I = 32V \Rightarrow I = 4A$$

$$V_{ab} = 5.4 + 8V = 28\,V$$

## 4. Question 2.18

Calculate the power dissipated in the 5Ω resistor in the circuit of figure




Solution:

The cycle is colored blue above. Then equation

$$-45\,V + V_o - 3V_o + 5.I = 0 \quad , \quad V_o = I.1\Omega$$

$$45V = 3V_o$$

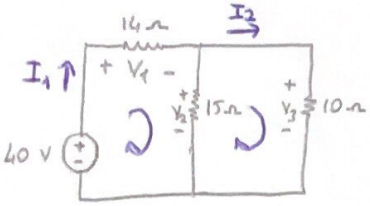
$$V_o = 15\,V$$

$$I = 15A$$

$$P = I^2.R = 15^2.5 = 1125\,W$$

5_ Question 2.24

Find $V_1$, $V_2$ and $V_3$ in the circuit in Figure.




Solution:

The cycles and currents are colored blue. So equations

$-40V + 14.I_1 + 15.(I_1 - I_2) = 0$

① $29I_1 - 15I_2 = 40$

$10.I_2 + 15.(I_2 - I_1) = 0$

② $-15I_1 + 25I_2 = 0$

$I_2 = \frac{3}{5} I_1$

replace equation 1

$29I_1 - 15.\frac{3}{5}I_1 = 40 \Rightarrow I_1 = 2\,A, \quad I_2 = \frac{6}{5}\,A$

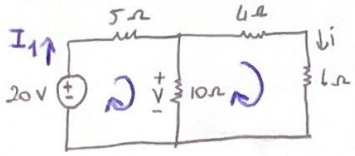
$V_1 = 14.I_1 = 14.2 = 28\,V$

$V_2 = 15.(I_1 - I_2) = 15.(2 - \frac{6}{5}) = 12\,V$

$V_3 = 10.I_2 = 10.\frac{6}{5} = 12\,V$

6_ Question 2.27

In the circuit in Figure, find $V$, $i$, and the power absorbed by the 4Ω resistor.



Solution:

The cycles and $I_1$ are colored blue in Figure. So equations

$$-20 + 5I_1 + 10.(I_1 - i) = 0$$

$$15I_1 - 10i = 20$$

$$\textcircled{1} \quad 3I_1 - 2i = 4$$

$$4i + 6i + 10.(i - I_1) = 0$$

$$\textcircled{2} \quad -10I_1 + 20i = 0$$

$$I_1 = 2i$$

use in equation 1

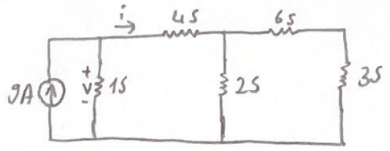
$$3.2i - 2i = 4 \Rightarrow i = 1A, \quad I_1 = 2A$$

$$V = 10.(I_1 - i) = 10.(2-1) = 10\ V$$

Power absorbed by 4Ω resistor is $P = I^2.R = 1^2.4 = 4\ W$

7. Question 2.29

Obtain V and i in the circuit in Figure




Solution:

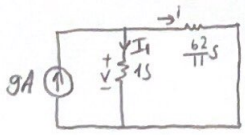
Let's simplify the circuit. 6S and 3S resistors are series. Then equivalent and 2S resistors are parallel. Then equivalent and 4S resistors are series.

$$6S + 3S = 9S$$

$$\frac{1}{Req} = \frac{1}{9S} + \frac{1}{2S} \Rightarrow Req = \frac{18}{11}\ S$$

$$\frac{18}{11}\ S + 4S = \frac{62}{11}\ S$$

. The circuit




$$I_1.1S = i.\frac{62}{11}S$$

$$\textcircled{1} \quad I_1 = \frac{62}{11}i$$

$$9A = I_1 + i$$

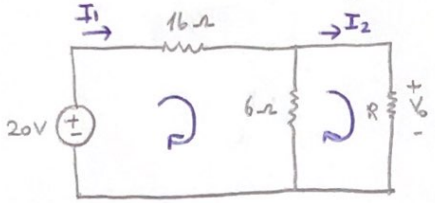
$$9A = \frac{62}{11}i + i$$

$$i = 1{,}35\ A$$

$$V = I1.1 = 1{,}35\ V$$

8. Question 2.33

In the circuit of Figure, find R if $V_b = 4V$




Solution:

The cycles and currents are colored blue above So, equations

$$-20\,V + 16I_1 + 6.(I_1 - I_2) = 0$$

$$22I_1 - 6I_2 = 20$$

$$\textcircled{1}\quad 11I_1 - 3I_2 = 10$$

$$4V + 6.(I_2 - I_1) = 0$$

$$-6I_1 + 6I_2 = -4$$

$$\textcircled{2}\quad -3I_1 + 3I_2 = -2$$

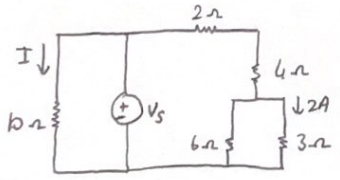
Add equation 1 and 2, then

$$8I_1 = 8 \Rightarrow I_1 = 1A,\ I_2 = \frac{1}{3}A$$

$$I_2 . R = 4V \Rightarrow R = 12\,\Omega$$

9. Question 2.34

Find I and $V_s$ in the circuit of Figure if the current through the 3Ω resistor is 2A

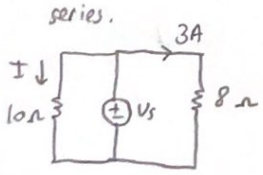



Solution:

6Ω branch and 3Ω branch voltages are should be equal.

$3.2A = 6.I' \Rightarrow I' = 1A$, So the total voltage 3A on the 4Ω branch.

Then let's simplify circuit. 6Ω and 3Ω are parallel then 4Ω and 2Ω are series.

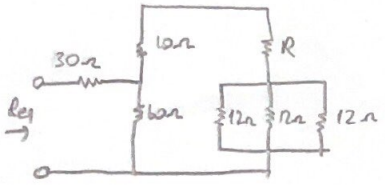



$$8.3A = 10.I \qquad V_s = \left(\frac{1}{10} + \frac{1}{8}\right)^{-1} . 5,4 = 24\,V$$

$$I = 2,4A$$

10. Question 2.37

If $R_{eq} = 50\ \Omega$ in the circuit in Figure, find R




Solution:

12 Ω resistors are parallels. The equivalent, R and 10 Ω resistors are series. Then equivalent and 60 Ω resistor are parallel. And last equivalent and 30 Ω resistor are series and the equivalent is 50 Ω.

1- $\frac{1}{R_{eq}} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} \Rightarrow R_{eq} = 4\ \Omega$

2- $10 + R + 4 = 14 + R$

3- $\frac{1}{R_{eq}} = \frac{1}{14+R} + \frac{1}{60} \Rightarrow R_{eq} = \left(\frac{1}{14+R} + \frac{1}{60}\right)^{-1}$

4- $30 + \left(\frac{1}{14+R} + \frac{1}{60}\right)^{-1} = 50$

$\left(\frac{1}{14+R} + \frac{1}{60}\right)^{-1} = 20$

$\frac{1}{14+R} + \frac{1}{60} = \frac{1}{20} \Rightarrow \frac{1}{14+R} = \frac{1}{30} \Rightarrow 14 + R = 30$

$R = 16\ \Omega$