Electrical Engineering

HW 1 – Chapter 2, Solution

<1>

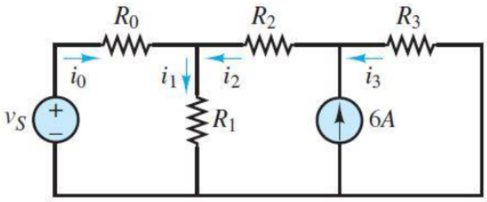


Figure P2.13

Solution:

Known quantities:

$i_o = 2$ A, $i_2 = -7$ A

Find:

a) i_1
b) i_3

Analysis:

a) Use KCL at the node between R_o, R_1, and R_2.

$$i_0 - i_1 + i_2 = 0$$

$$i_1 = i_0 + i_2$$

$$\boldsymbol{i_1 = -5A}$$

b) Use KCL at the node between R_2, R_3, and the current source.

$$6A + i_3 - i_2 = 0$$

$$i_3 = i_2 - 6A$$

$$\boldsymbol{i_3 = -11A}$$

<2>

Problem 2.17

Use KCL to determine the unknown currents in Figure P2.17.

Solution:

Known quantities:

$i_a = -2$ A, $i_b = 6$ A, $i_c = 1$ A, $i_d = -4$ A

Find:

a) i_1
b) i_2
c) i_3
d) i_4

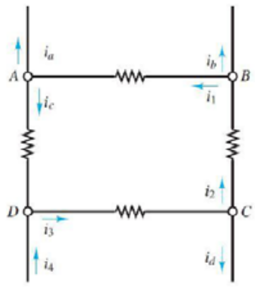


Figure P2.17

Analysis:

a) Use KCL at Node A.

$$i_1 - i_a - i_c = 0$$

$$i_1 = i_a + i_c$$

$$\boldsymbol{i_1 = -1A}$$

b) Use KCL at Node B.

$$i_2 - i_1 - i_b = 0$$

$$i_2 = i_1 + i_b$$

$$\boldsymbol{i_2 = 5A}$$

c) Use KCL at Node C.

$$i_3 - i_2 - i_d = 0$$
$$i_3 = i_2 + i_d$$
$$\boldsymbol{i_3 = 1A}$$

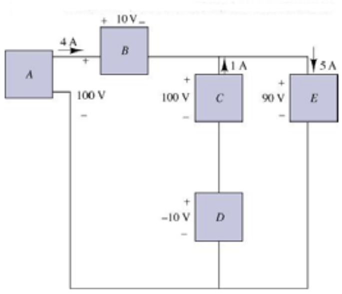
d) Use KCL at Node D.

$$i_c + i_4 - i_3 = 0$$
$$i_4 = i_3 - i_c$$
$$\boldsymbol{i_4 = 0A}$$

<3>

Problem 2.24

For the circuit shown in Figure P2.24, determine which components are supplying power and which are dissipating power. Also determine the amount of power dissipated and supplied.



Solution:

Known quantities:

Circuit shown in Figure P2.24.

Find:

Determine power absorbed or power delivered and corresponding amount.

Analysis:

If current direction is out of power source, then power source is supplying, otherwise it is absorbing.

A supplies $(100V)(4A) = 400$ W

B absorbs $(10V)(4A) = 40$ W

C supplies $(100V)(1A) = 100W$

D supplies $(-10V)(1A) = -10W$, i.e absorbs $10W$

E absorbs $(90V)(5A) = 450W$

<4>

Find:

a) Equivalent resistance
b) Power delivered.

Analysis:

(a)

$$2\Omega + 1\Omega = 3\Omega$$
$$3\Omega \| 3\Omega = 1.5\Omega$$
$$4\Omega + 1.5\Omega + 5\Omega = 10.5\Omega$$
$$10.5\Omega \| 6\Omega = 3.818\Omega$$
$$R_{eq} = 3.818\Omega + 7\Omega = 10.818\Omega$$

(b)

$$P = \frac{14^2}{10.818} = 18.12\text{W}$$

<5>

Solution:

Known quantities:

Circuit of Figure P2.59. R_1=10Ω, R_2=5 Ω, R_3=8 Ω, R_4=2 Ω, R_5=4 Ω, R_6=2 Ω, R_7=1 Ω, R_8=10 Ω v_s=20V.

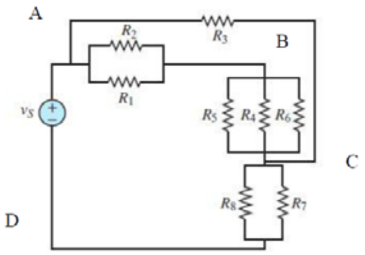


Figure P2.59

Find:

The equivalent resistance seen by the voltage source.
The current through R_7.

Analysis:

Count the nodes:

$$\boldsymbol{Nodes = 4}$$

Nodes A, B, C, & D as shown above.

Combine R_1 and R_2:

$$R_1||R_2 = 3.33\Omega$$

$R_{4\text{-}6}$are in parallel with each other and in series with $R_{1||2}$:

$$R_4||R_5||R_6 + R_{1||2} = 4.13\Omega$$

The previous resistance is in parallel with R_3:

$$R_3||4.13\Omega = 2.72\Omega$$

R_7 is in parallel with R_8:

$$R_8||R_7 = 0.91\Omega$$

These last two resistances are in series and are equal to the equivalent resistance:

$$\boldsymbol{R_{eq} = 3.63\Omega}$$

The current through $R_{7||8}$ will be the same as the total current through the circuit. Find the total current then use current division to find the current through R_7:

$$I = \frac{v_s}{R_{eq}} = 5.51A$$

$$\boldsymbol{I_{R_7} = I * \frac{R_{78}}{R_7} = 5.01A}$$