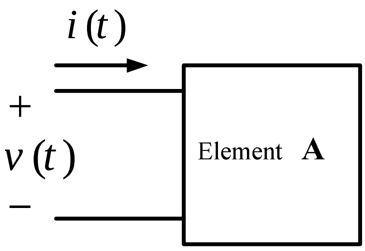
Problem No 1 (40)

Q1 The total charge $q(t)$ entering the element **A** shown below (**Figure 1**)



$$q(t) = \frac{t}{100} e^{-200t} \quad \text{C}, \quad t \geq 0$$

Figure 1

The current induced by the charge is equal to

(a) $i(t) = \frac{1}{100} e^{-200t} - 2te^{-200t}$ A, $t \geq 0$

(b) $i(t) = \frac{t}{2} e^{-200t}$ A, $t \geq 0$

(c) $i(t) = \frac{t}{100} e^{-200t}$ A, $t \geq 0$

(d) $i(t) = e^{-200t} + e^{200t}$ A, $t \geq 0$

Q2 For the circuit shown below (**Figure 2**)

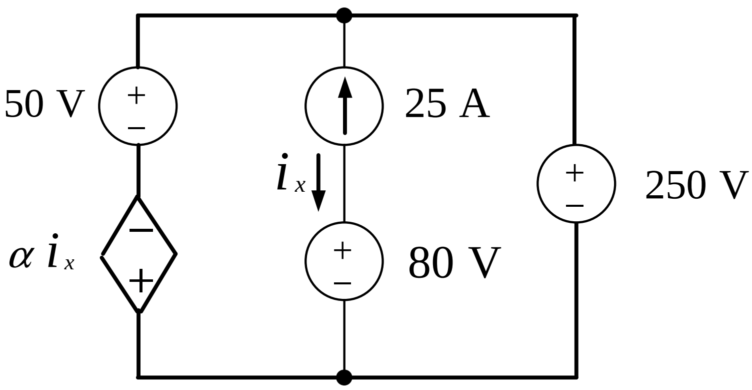


Figure 2

The value of α that will make the connection a valid connection

(a) $\alpha = 8$ (b) $\alpha = 12$ (c) $\alpha = -8$ (d) $\alpha = -12$

Q3 For the circuit shown below (**Figure 3**), if the voltage v across the resistor R is

$$\frac{V_s}{3} \le v \le \frac{V_s}{2}$$

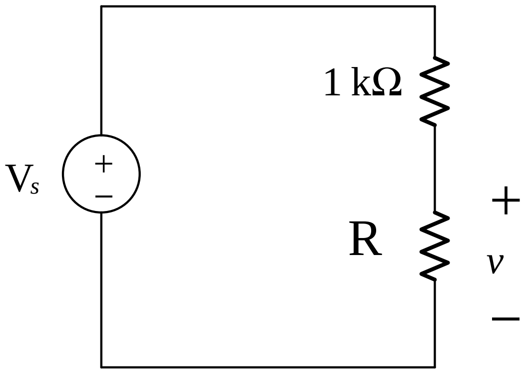


Figure 3

Then the choice of the resistor R is

(a) R = 500Ω

(b) 500 Ω ≤ R ≤ 1000 Ω

(c) 100 Ω ≤ R ≤ 200 Ω

(d) R ≥ 1000Ω

Q4 Two resistances R_1 and R_2 give combined resistance of 4.5 Ω when in series and 1 Ω when in parallel. The resistances are

(a) R_1=3Ω and R_2= 6Ω

(b) R_1=3Ω and R_2= 9Ω

(c) R_1=1.5Ω and R_2= 3Ω

(d) R_1=1.5Ω and R_2= 0.5Ω

Q5 For the circuit shown below (**Figure 4**),

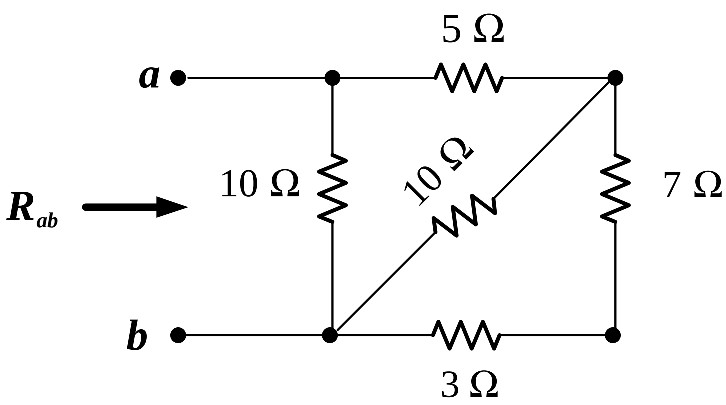


Figure 4

The equivalent resistant R_{ab} between a and b is

(a) $R_{ab} = 35\ \Omega$ (b) $R_{ab} = 25\ \Omega$ (c) $R_{ab} = 15\ \Omega$ (d) $R_{ab} = 5\ \Omega$

Q6 For the circuit shown below (**Figure 5**),

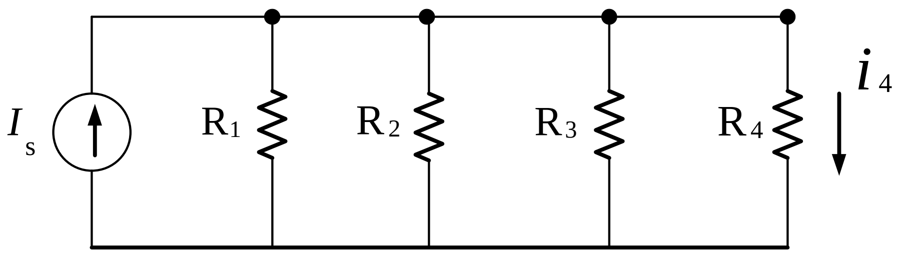


Figure 5

The current i_4 is

(a) $i_4 = \dfrac{R_4}{R_1+R_2+R_3+R_4} I_s$

(b) $i_4 = \dfrac{R_1R_2+R_1R_3+R_1R_4}{R_1+R_2+R_3+R_4} I_s$

(c) $i_4 = \dfrac{R_1R_2R_3}{R_2R_3R_4+R_1R_3R_4+R_1R_2R_4+R_1R_2R_3} I_s$

(d) $i_4 = \dfrac{R_1R_2R_3}{R_1+R_2+R_3+R_4} I_s$

Q7

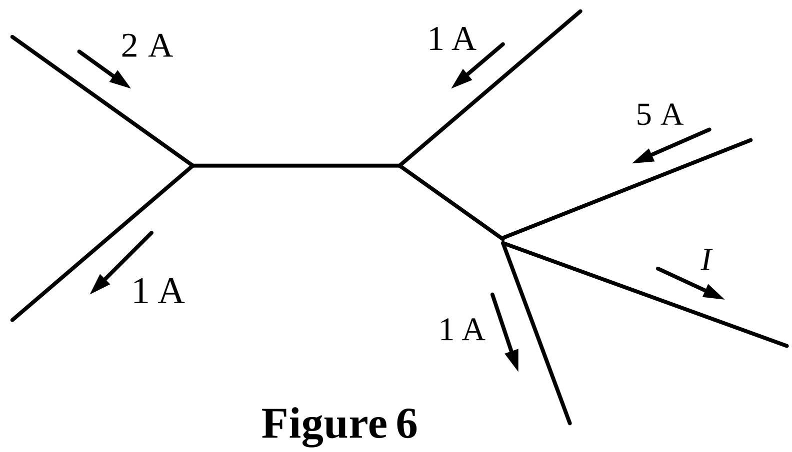


Figure 6

The current I in **Figure 6** is

(a) I =8 A (b) I =7 A (c) I = 6 A (d) I = 5A

Q8 For the circuit shown below (**Figure 7**),

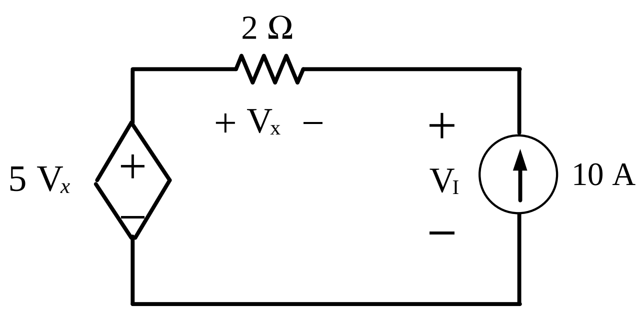


Figure 7

The voltage across the independent current source V_I is

(a) $V_I = -80V$ (b) $V_I = +80$ V (c) V_I=120 V (d) $V_I = -120$ V

Q9 For the circuit shown below (**Figure 8**),

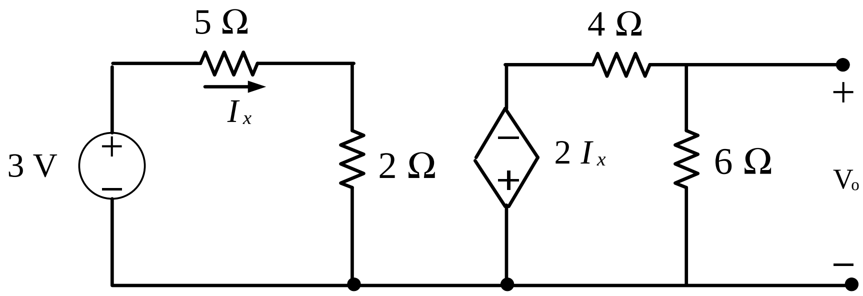


Figure 8

The voltage V_o is

(a) $V_o = \frac{35}{18}$ V (b) $V_o = -\frac{35}{18}$ V (c) $V_o = \frac{36}{70}$ V (d) $V_o = -\frac{36}{70}$ V

Q10 For the circuit shown below (**Figure 9**),

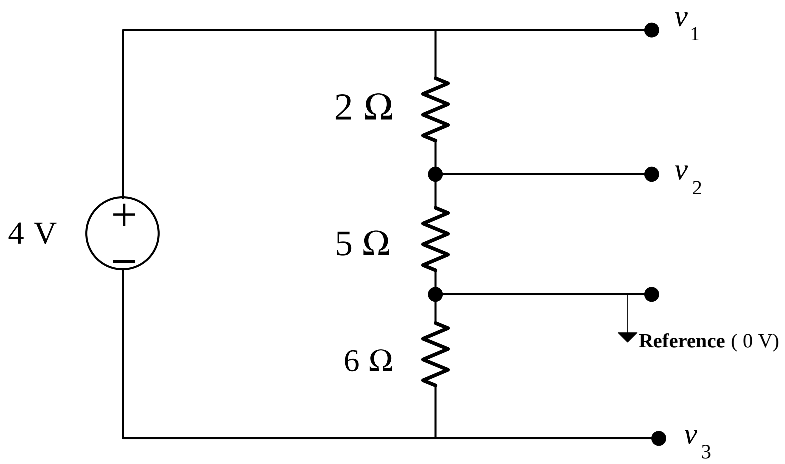


Figure 9

The nodes voltages v_1, v_2, v_3 with respect to the reference voltage are

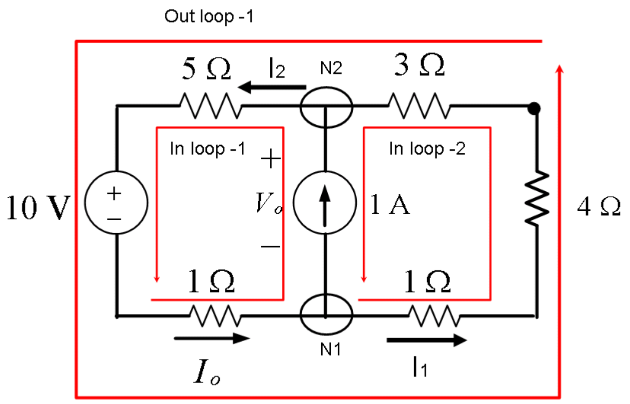
(a) $v_1 = \frac{8}{13}$ $v_2 = \frac{20}{13}$ $v_3 = \frac{24}{13}$

(b) $v_1 = \frac{8}{13}$ $v_2 = \frac{20}{13}$ $v_3 = -\frac{24}{13}$

(c) $v_1 = \frac{28}{13}$ $v_2 = \frac{20}{13}$ $v_3 = \frac{24}{13}$

(d) $v_1 = \frac{28}{13}$ $v_2 = \frac{20}{13}$ $v_3 = -\frac{24}{13}$

Problem No 2 (20)



Let the circuit as shown above. Using directly KVL, KCL and ohm's law find V_o and I_o ? **(Do Not Use Node Voltage Method or Mesh Method)**

KCL at Node-1: -I1 +Io -1 = 0 => I1=Io-1

KCL at Node-2: -I2 +1 +I1 = -I2 +1 +(Io -1) = 0 => I2 = I0

KVL Out loop -1: 10 + Io +8· I1 + 5· I2 =

+10 + Io +8· (Io-1) + 5· Io = 14· I0 + 2 =0

=> I0 = -1/7

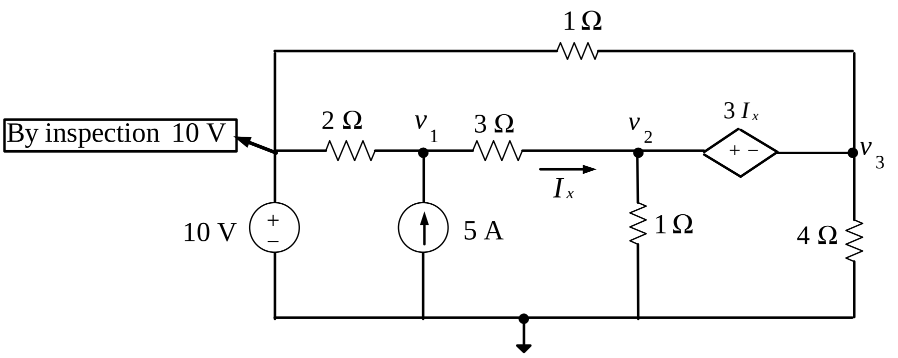
KVL in Loop-1: +10 +Io – Vo +5· I2 =+10 +Io – Vo +5·Io = 0

Vo= 64/7

Or

KVL in Loop-2: Vo + 8· I1 = Vo + 8· (Io – 1) = 64/7

Problem No 3 (25)



For the circuit shown above find the nodal equations necessary to solve for the node voltages v_1, v_2, v_3 and put your results in the matrix form as

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \end{bmatrix}$$

(DO NOT SOLVE THE SYTEM OF EQUATIONS)

Solution

KCL at $v_1 \Rightarrow \frac{v_1 - 10}{2} - 5 + \frac{v_1 - v_2}{3} = 0$

$\Rightarrow 5v_1 - 2v_2 = 60$ --------(1)

KCL at Supernode $\Rightarrow \frac{v_2 - v_1}{3} + \frac{v_2}{1} + \frac{v_3}{4} + \frac{v_3 - 10}{1} = 0$

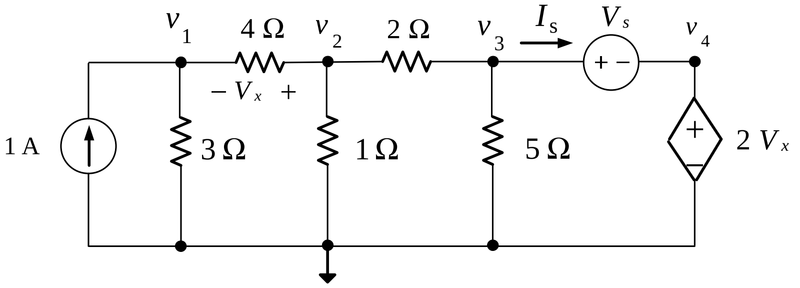
$\Rightarrow -4v_1 + 16v_2 + 15v_3 = 120$ --------(2)

Voltage Restrection $\Rightarrow v_2 - v_3 = 3I_x = 3\frac{v_1 - v_2}{3} = v_1 - v_2$

$\Rightarrow -v_1 + 2v_2 - v_3 = 0$ --------(3)

$$\Rightarrow \begin{bmatrix} 5 & -2 & 0 \\ -4 & 16 & 15 \\ -1 & 2 & -1 \end{bmatrix}\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} 60 \\ 120 \\ 0 \end{bmatrix}$$

Problem No 4 (15)



For the circuit shown above the nod voltages are given as :

$v_1 = 1.5$ V $\qquad v_2 = -0.5\ V \qquad v_3 = -2.5\ V$

(a) Find the node voltage v_4 ?

(b) The power delivered by the independent current source ?

(c) The power delivered by the independent voltage source ?

Solution

(a) $V_4 = 2V_x = 2(v_2 - v_1) = 2(-0.5 - 1.5) = -4$ V

(b) $P_{1A}^{absorbed} = -V_I(1)$

$\Rightarrow P_{1A}^{delivered} = V_I(1) = v_1(1) = (1.5)(1) = 1.5$ W

(c) $P_{V_s}^{absorbed} = V_s I_s$

$\Rightarrow P_{1A}^{delivered} = -V_s I_s$

$V_s = v_3 - v_4 = -2.5 - (-4) = 1.5$ V

$I_s = \frac{v_2 - v_3}{2} + \frac{0 - v_3}{5} = \frac{-0.5 + 2.5}{2} + \frac{2.5}{5} = 1.5$ A

$\Rightarrow P_{1A}^{delivered} = -(1.5)(1.5) = -2.25$ W