Summer 2022

CSE250 – Circuits and Electronics

Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL)

Purbayan Das, C. Lecturer
Department of Computer Science and Engineering (CSE)
BRAC University

Circuit laws, methods of analysis, & theorems

Laws

- Ohm's Law
- Kirchhoff's current law
- Kirchhoff's voltage law

Methods of analysis

- Nodal analysis
- Mesh analysis

Theorems

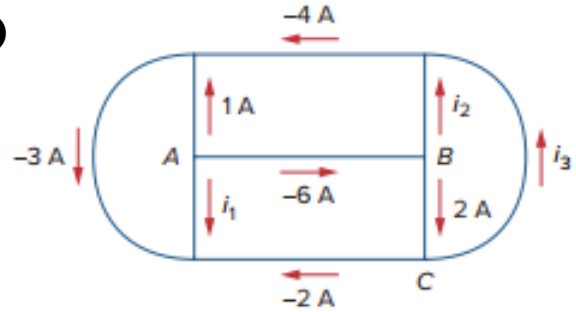
- Source transformation
- Superposition theorem
- Thevenin's theorem
- Norton's theorem
- Maximum power transfer theorem

Kirchhoff's Current Law (KCL)

- Kirchhoff's current law (KCL) the algebraic sum of the currents entering a node is equal to the algebraic sum of the currents leaving the node.

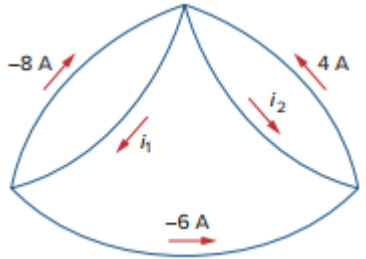
- Find i_1, i_2, and i_3

1



- Find i_1, i_2

2

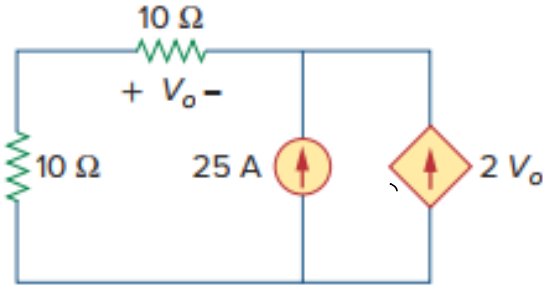


Ans:

1. $i_1 = 5$ A; $i_2 = -8$ A; $i_3 = 4$ A.
2. $i_1 = -14$ A; $i_2 = 10$ A.

Example 1

- Find V_0 and power absorbed by the dependent source.

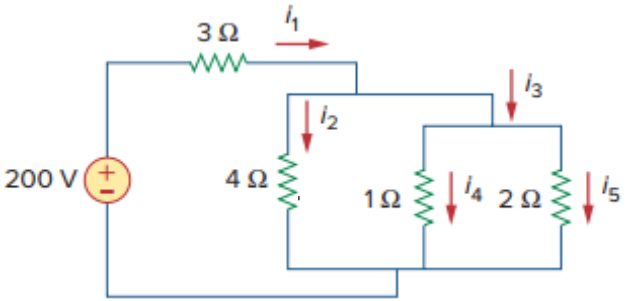


Ans: $\mathbf{V_0 = -\ 11.9\ V}$

$\mathbf{P_{absorbed} = 571.2\ W}$

Example 2

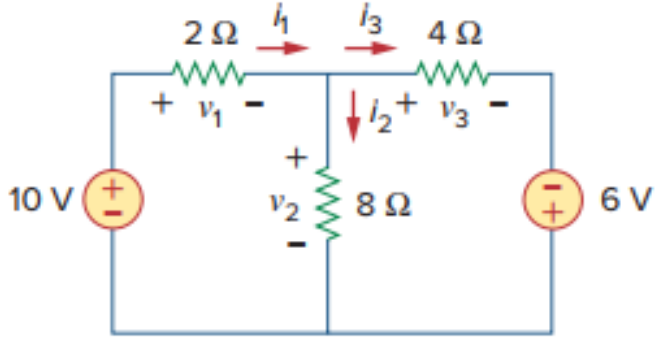
- Determine i_1 to i_5



Ans: $\mathbf{i_1 = 56\ A;\ i_2 = 8\ A;\ i_3 = 48\ A;\ i_4 = 32\ A;\ i_5 = 16\ A.}$

Example 3

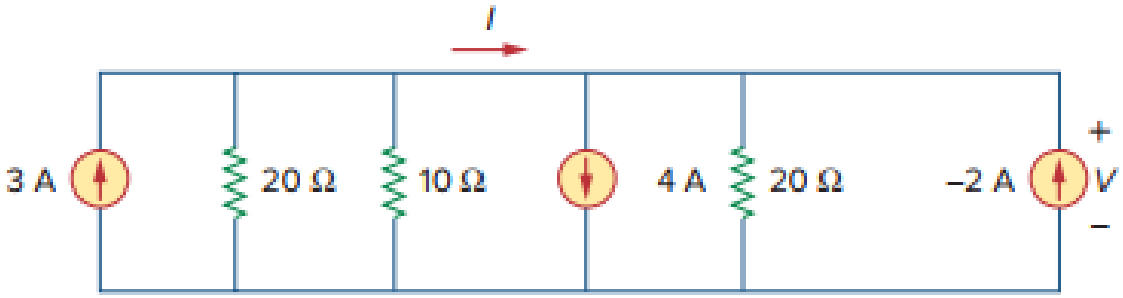
- Find the voltages and currents shown in the following circuit.



Ans: $v_1 = 6$ V; $v_2 = 4$ V; $v_3 = 10$ V.
$i_1 = 3$ A; $i_2 = 0.5$ A; $i_3 = 2.5$ A.

Example 4

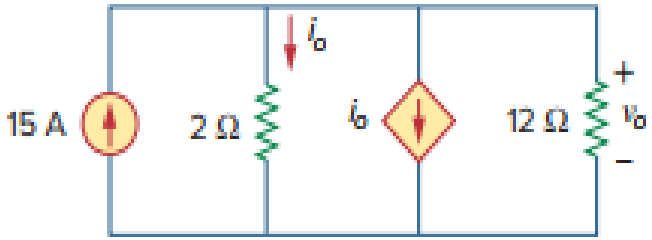
- Find the I and V shown in the following circuit.



Ans: **V = - 15 V; I = 5.25 A.**

Example 5

- Determine $\mathbf{v_0}$ and $\mathbf{i_0}$



Ans: $\mathbf{v_0 = 20\ V;\ i_0 = 10\ A.}$

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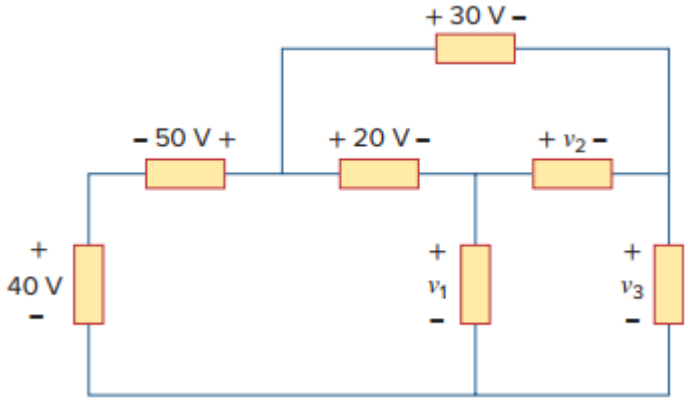
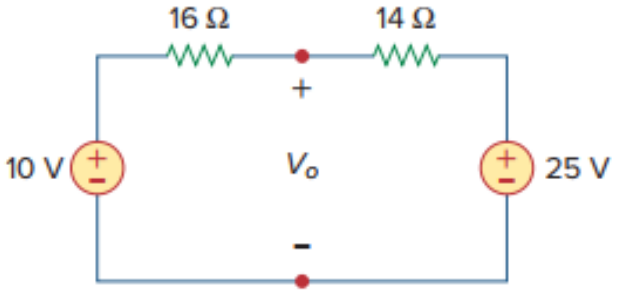
Kirchhoff's Voltage Law (KVL)

- Kirchhoff's voltage law (KVL) states that the algebraic sum of all voltages around a closed path (or loop) is zero.

❶ Determine v_1, v_2, v_3



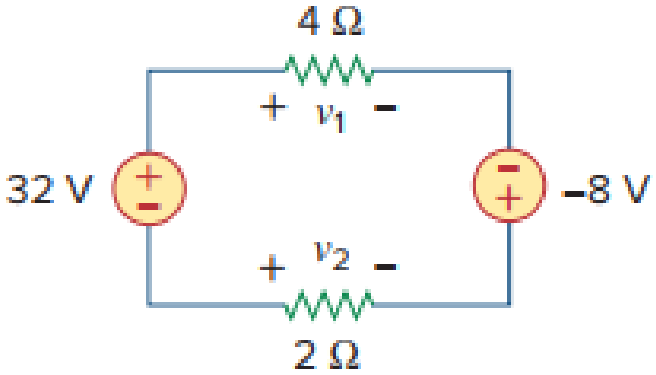
❷ Determine v_0



Ans: **(1) v_1 = 70 V; v_2 = 10 V; v_3 = 60 V**
(2) v_0 = 18 V.

Example 6

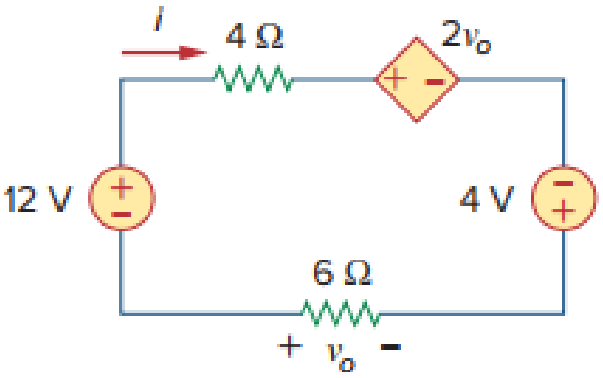
- Find V_1 and V_2 in the circuit



Ans: $\mathbf{v_1 = 20\ V;\ v_2 = -\ 8\ V}$.

Example 7

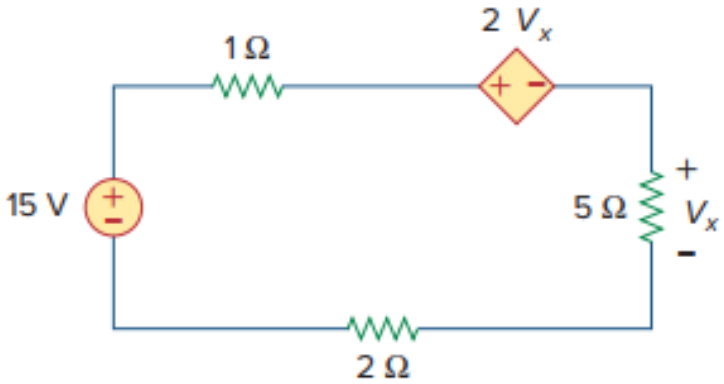
- Find V_0 and I in the circuit



Ans: $\mathbf{v_0 = 48\ V;\ I = -\ 8\ A}$.

Example 8

- Find V_x



Ans: $\mathbf{v_x = 4.167\ V}$.

Thank you for your attention