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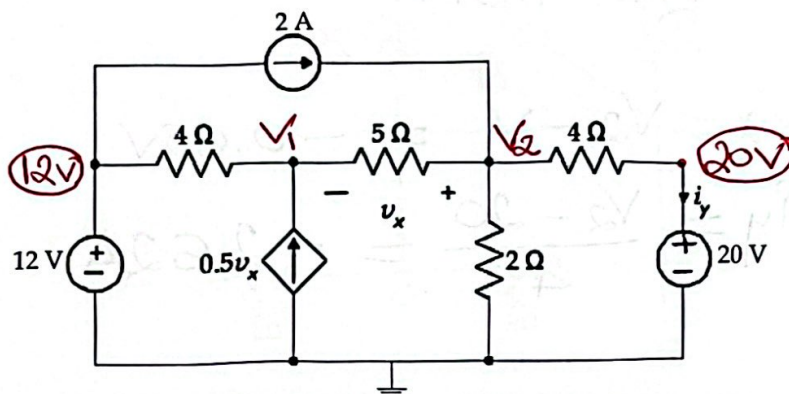
Brac University

Faculty : AQT

CSE250 Circuits and Electronics

Quiz 1

Question 1 of 2 [20 marks]



- Apply Nodal Analysis to identify the values of the node voltages. (18 marks)
- What is the value of v_x and i_y ? (with appropriate \pm sign)? (2 marks)

KCL at node 1, (3 elements connected)

$$0.5v_x = \frac{v_1 - 12}{4} + \frac{v_1 - v_2}{5}$$

$$\Rightarrow 0.5(v_2 - v_1) = \frac{v_1}{4} - 3 + \frac{v_1}{5} - \frac{v_2}{5} \quad [v_x = v_2 - v_1]$$

$$\Rightarrow 0.5v_2 - 0.5v_1 = \frac{v_1}{4} - 3 + \frac{v_1}{5} - \frac{v_2}{5}$$

$$\Rightarrow v_1 \left(\frac{1}{4} + \frac{1}{5} + \frac{1}{2} \right) + v_2 \left(-\frac{1}{5} - \frac{1}{2} \right) = 3$$

$$\Rightarrow \frac{19}{20}v_1 - \frac{7}{10}v_2 = 3 \quad \text{--- (I)}$$

KCL at node 2, (4 elements connected)

$$2 = \frac{v_2 - 0}{2} + \frac{v_2 - v_1}{5} + \frac{v_2 - 20}{4}$$

$$\Rightarrow 2 = \frac{v_2}{2} + \frac{v_2}{5} - \frac{v_1}{5} + \frac{v_2}{4} - 5$$

$$\Rightarrow -\frac{1}{5}v_1 + v_2 \left(\frac{1}{2} + \frac{1}{5} + \frac{1}{4} \right) = 7$$

$$\Rightarrow -\frac{1}{5}v_1 + \frac{19}{20}v_2 = 7 \quad \text{--- (II)}$$

Solving eqⁿs ① & ②,

$$V_1 = 10.16V$$

$$V_2 = 9.51V$$

$$V_x = V_2 - V_1 = -0.65V$$

$$I_y = \frac{V_2 - 20}{4} = -2.62A$$

(reference chosen as 0) (1 above 0)

$$\frac{8V - V}{8} + \frac{8V - V}{4} = 0$$

$$[V - 8 = 0] \quad \frac{V}{8} - \frac{V}{8} + 8 - \frac{V}{4} = 0$$

$$\frac{V}{8} - \frac{V}{8} + 8 - \frac{V}{4} = 0$$

$$8 = \left(\frac{1}{8} - \frac{1}{8} - \frac{1}{4}\right)V$$

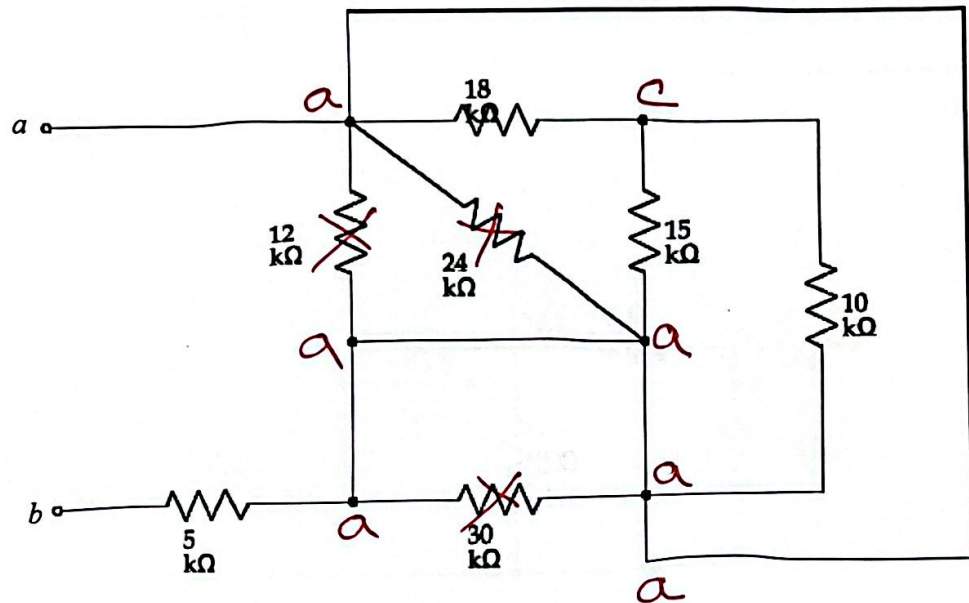
$$8 = \left(-\frac{1}{4}\right)V$$

(reference chosen as 0) (1 above 0)

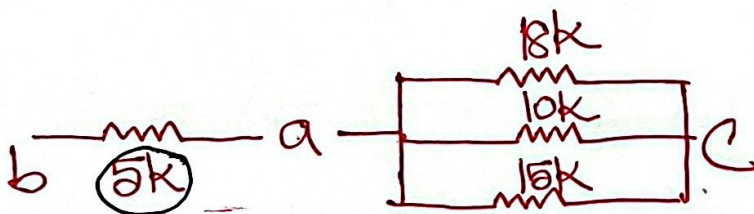
$$8 = \left(-\frac{1}{4}\right)V$$

■ Question 2 of 2

[5 marks] Determine R_{ab} the equivalent resistance between the terminals a and b in the circuit shown below.



- ① Identify the nodes
- ② Simplify the circuit



- ③ Determine resistance value R_{ab} (resistance between a and b)
 $= 5 k\Omega$