

WELCOME TO GATE Adda 247

**PAID COURSES OF GATE 2024/25 ARE
AVAILABLE FOR ALL STREAMS (EE/EC/ME/CE)**

USE CODE

(Y503)

FOR BEST MENTORSHIP AND MAXIMUM DISCOUNTS

Mesh/Loop

* (mesh/loop) can be closed/open.

ex:- Determine Vol. across Switch for $t < 0$.

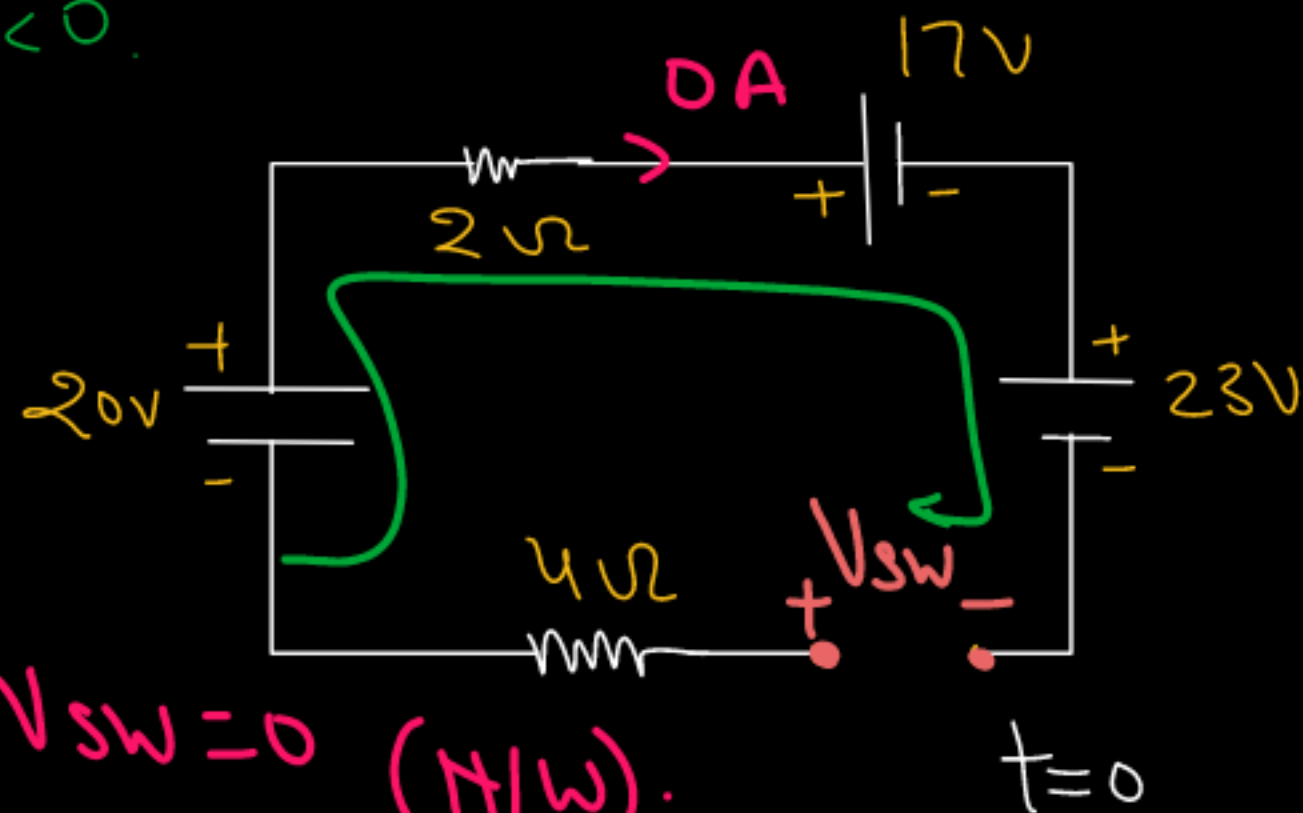
Soln: $t < 0$.

s/w \rightarrow open.

By KVL:-

$$-20 + 17 + 23 - V_{sw} = 0 \quad (\text{H/W}).$$

$$[V_{sw} = 20 \text{ Volts}]$$



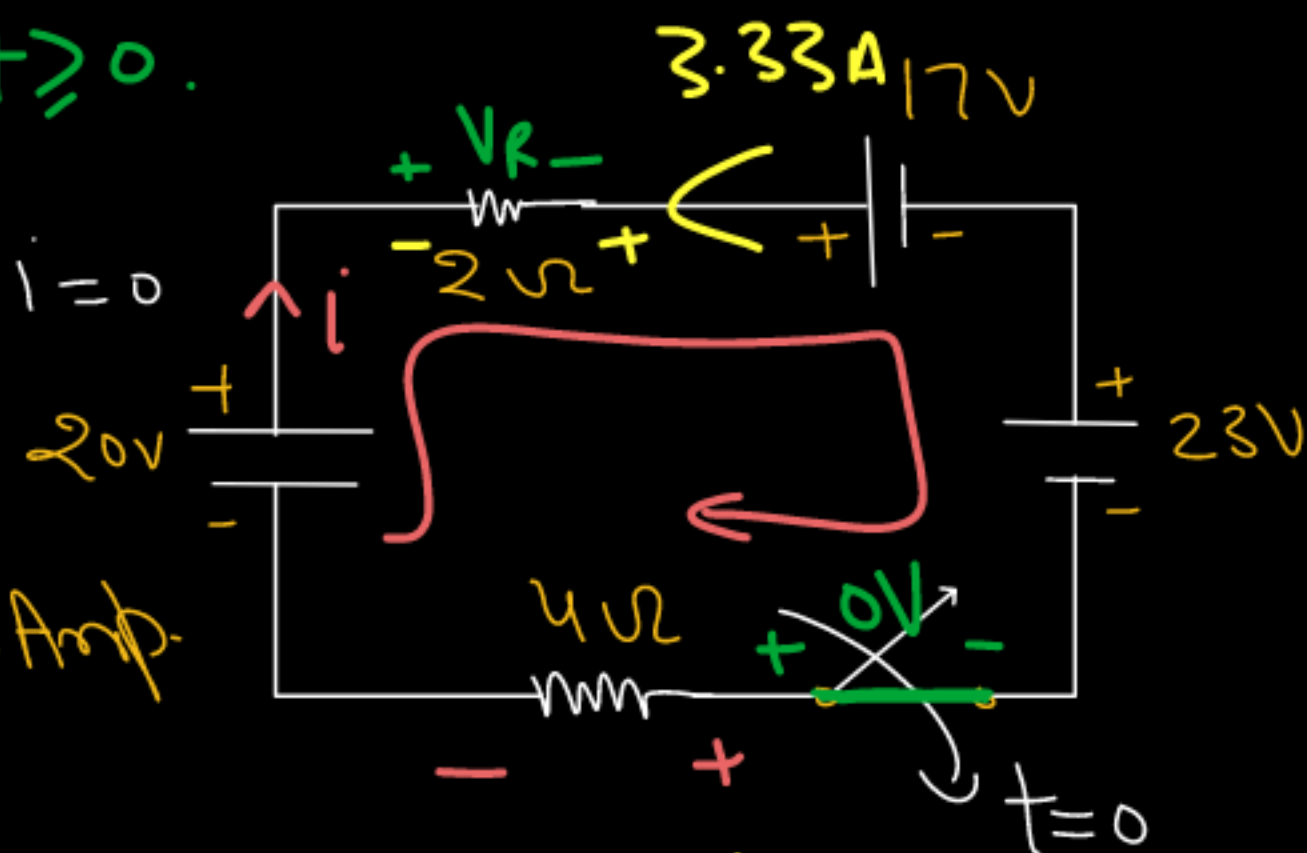
ex:- $V_R = ?$, $t \geq 0$.

$$-20 + 2i + 17 + 23 + 4i = 0$$

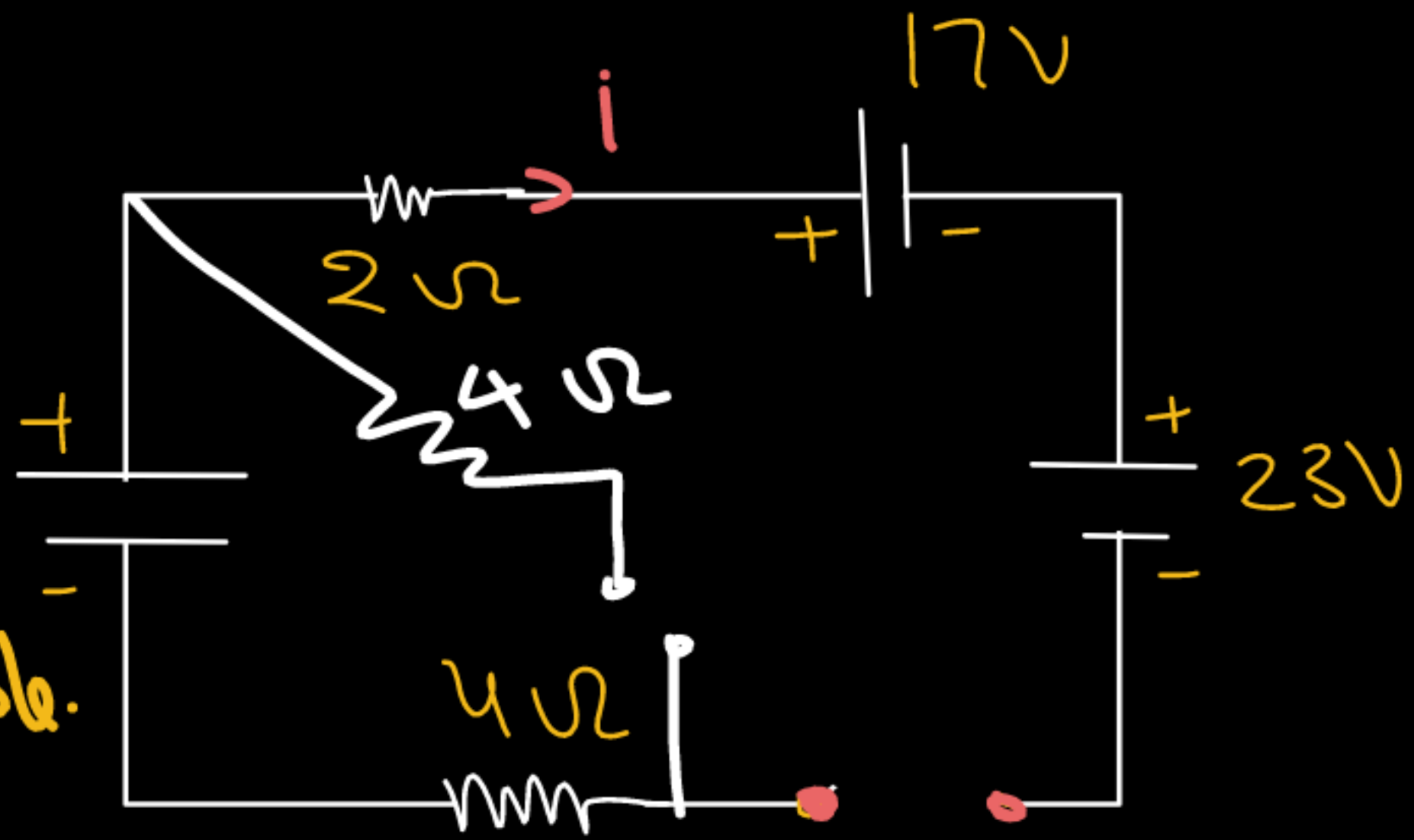
$$6i = -20$$

$$i = \frac{-20}{6} = -3.33 \text{ Amp.}$$

$$\therefore V_R = -3.33 \times 2 = \underline{\underline{-6.67 \text{ Volts}}}$$

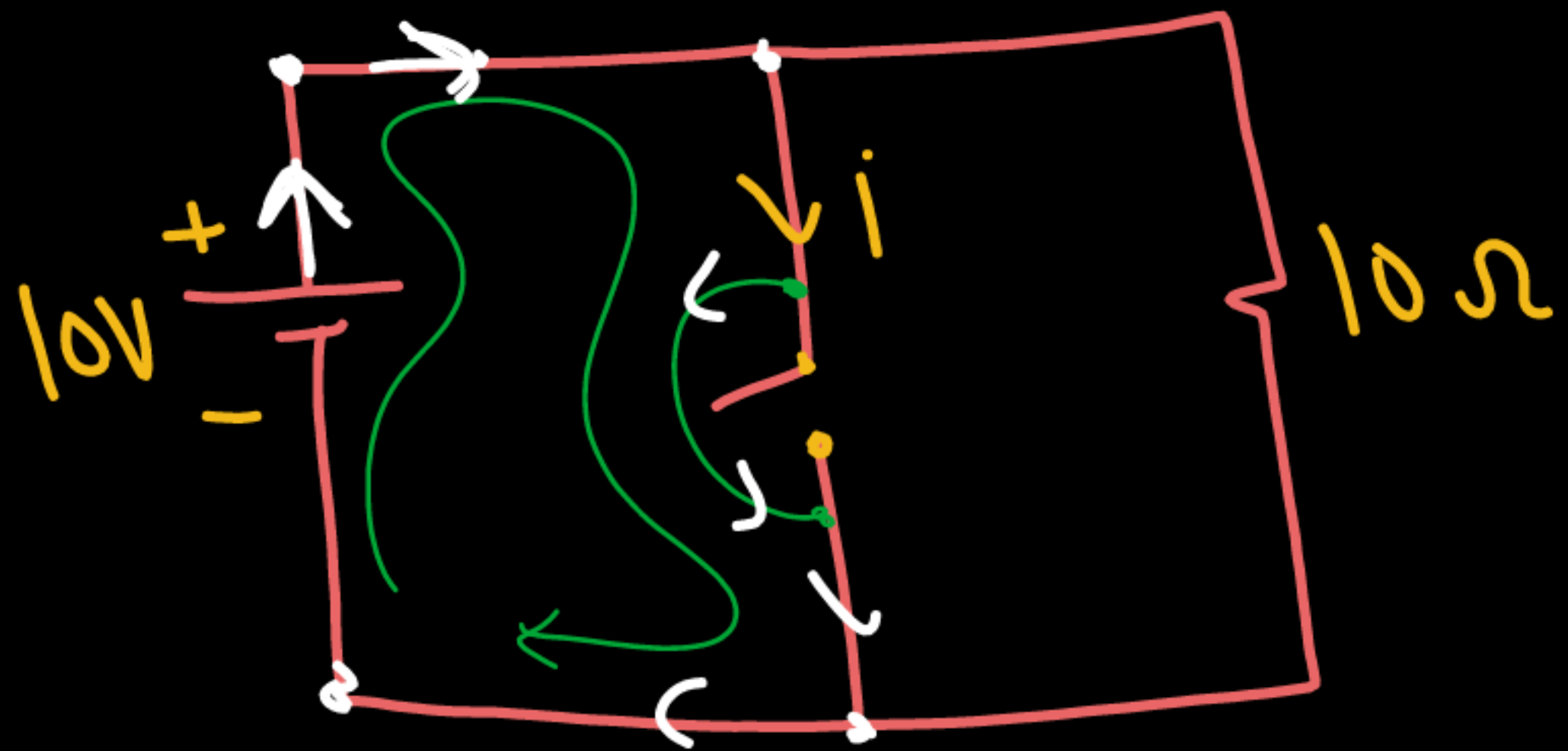


* when, (N/w) is not closed, then KCL is not applicable, but KVL is applicable.



* when, (S/w is closed) or ckt is S/C, Then KVL not valid, but KCL is valid.

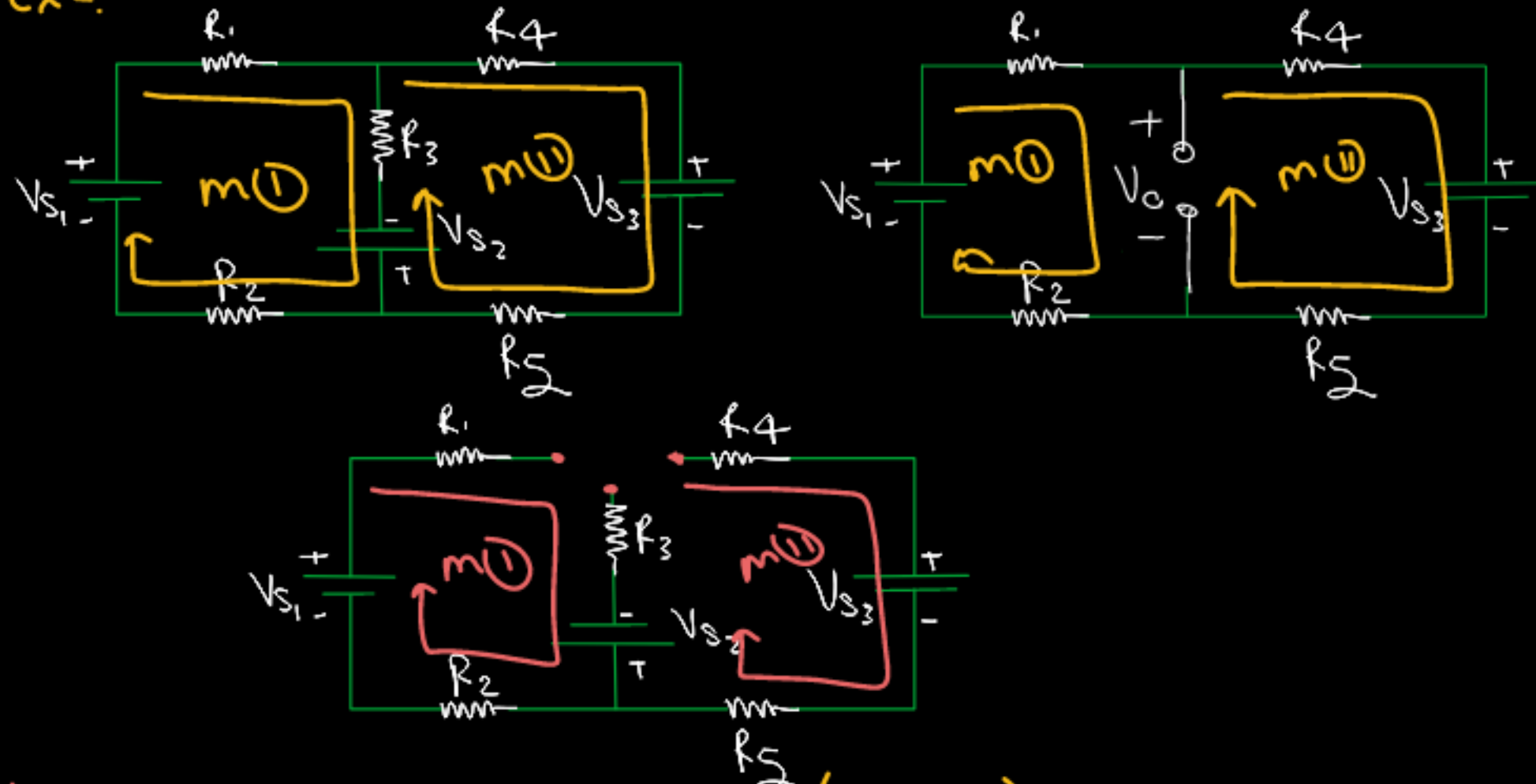
(N/w) not a ckt.



Mesh/Loop

⇒ mesh is smallest (closed/open) ckt of a network.

For ex:-



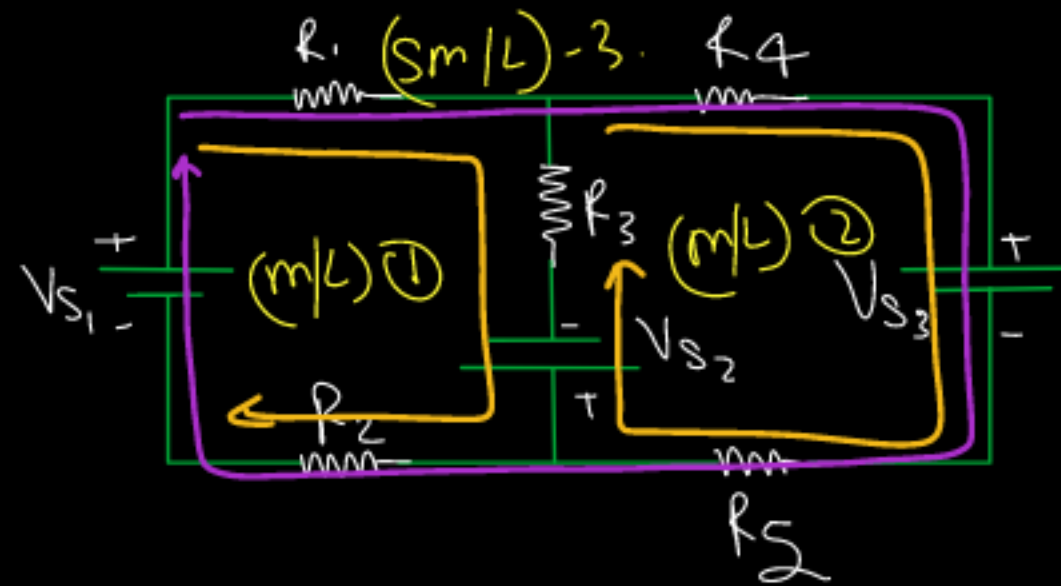
ex:-

Loop:- it can be (smallest/longest) ckt of a network.

⇒ every mesh will be a loop, but every loop (may/may not) be a mesh.

⇒ no. of mesh = 2

no. of loop = 3.

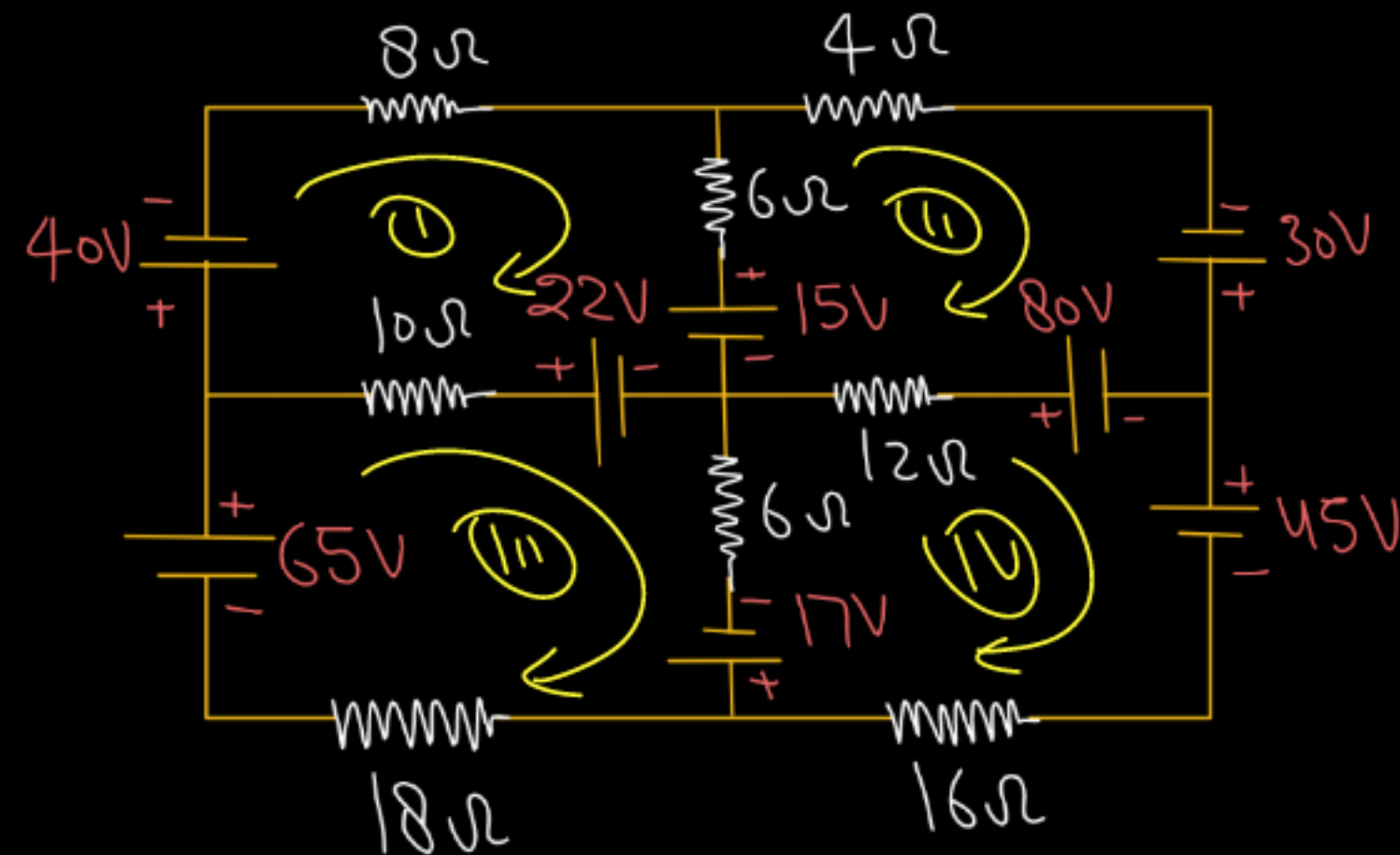


Ex. Write down all possible KVL Equations for given Circuit

Solnⁿ:- find out no. of relevant mesh/loop.

- Assume current for every mesh/loop in (clockwise/Ant-clockwise) direction.

* Assume an unknown Vol. for every given current source.



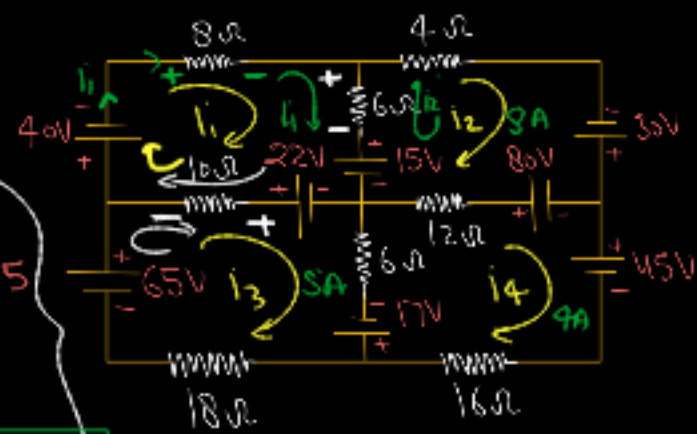
⇒ (mesh/loop) current method:-

⇒ KVL for mesh ①

* let $-i_1$ is the highest current of ckt.

$$+40 + 8i_1 + 6(i_1 - i_2) + 15 - 22 + 10(i_1 - i_3) = 0$$

$$24i_1 - 6i_2 - 10i_3 = -33 \text{ (I)}$$



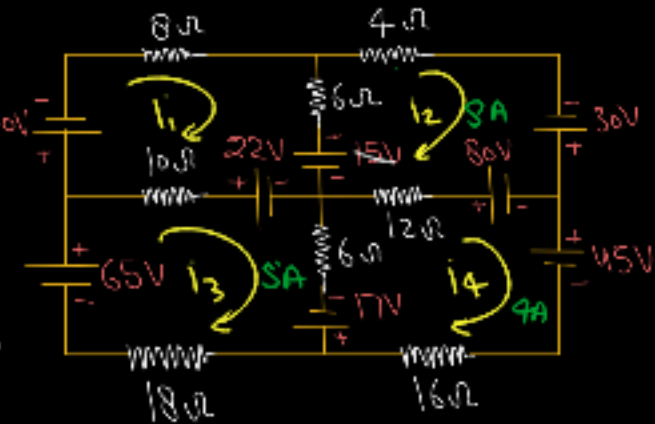
$$24i_1 - 6i_2 - 10i_3 = -33 \text{ (I)}$$

⇒ KVL for mesh ②

let $-i_2$ is highest current.

$$-15 + 6(i_2 - i_1) + 4i_2 - 30 - 80 + 12(i_2 - i_4) = 0$$

$$-6i_1 + 22i_2 - 12i_4 = 125 \text{ (II)}$$



Similarly ⇒

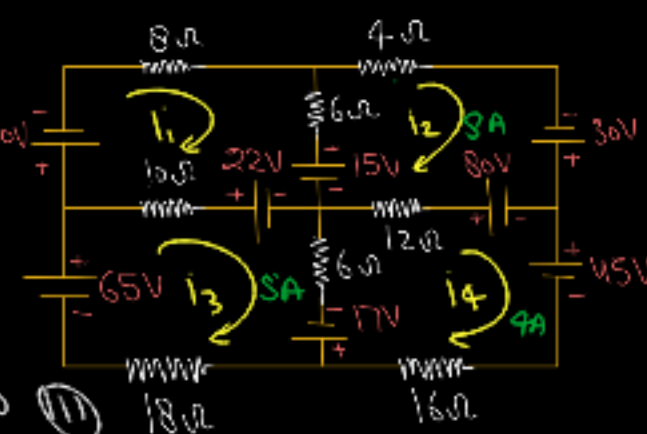
KVL for mesh ③ & mesh ④

$$-65 + 10(i_3 - i_1) + 22 + 6(i_3 - i_4) - 17 + 18i_3 = 0$$

$$-10i_1 + 34i_3 - 6i_4 = 60 \text{ (III)}$$

$$-5i_1 + 17i_3 - 3i_4 = 30 \text{ (IV)}$$

for mesh ④



$$24i_1 - 6i_2 - 10i_3 = -33 \text{ (I)}$$

$$12(i_4 - i_2) + 80 + 45 + 16i_4 + 17 + 6(i_4 - i_3) = 0$$

$$-6i_1 + 22i_2 - 12i_4 = 125 \text{ (II)}$$

$$-12i_2 - 6i_3 + 34i_4 = -142 \text{ (V)}$$

$$-6i_2 - 3i_3 + 17i_4 = -71 \text{ (VI)}$$

$$i_1 = ?$$

$$i_2 = ?$$

$$i_3 = ?$$

$$i_4 = ?$$

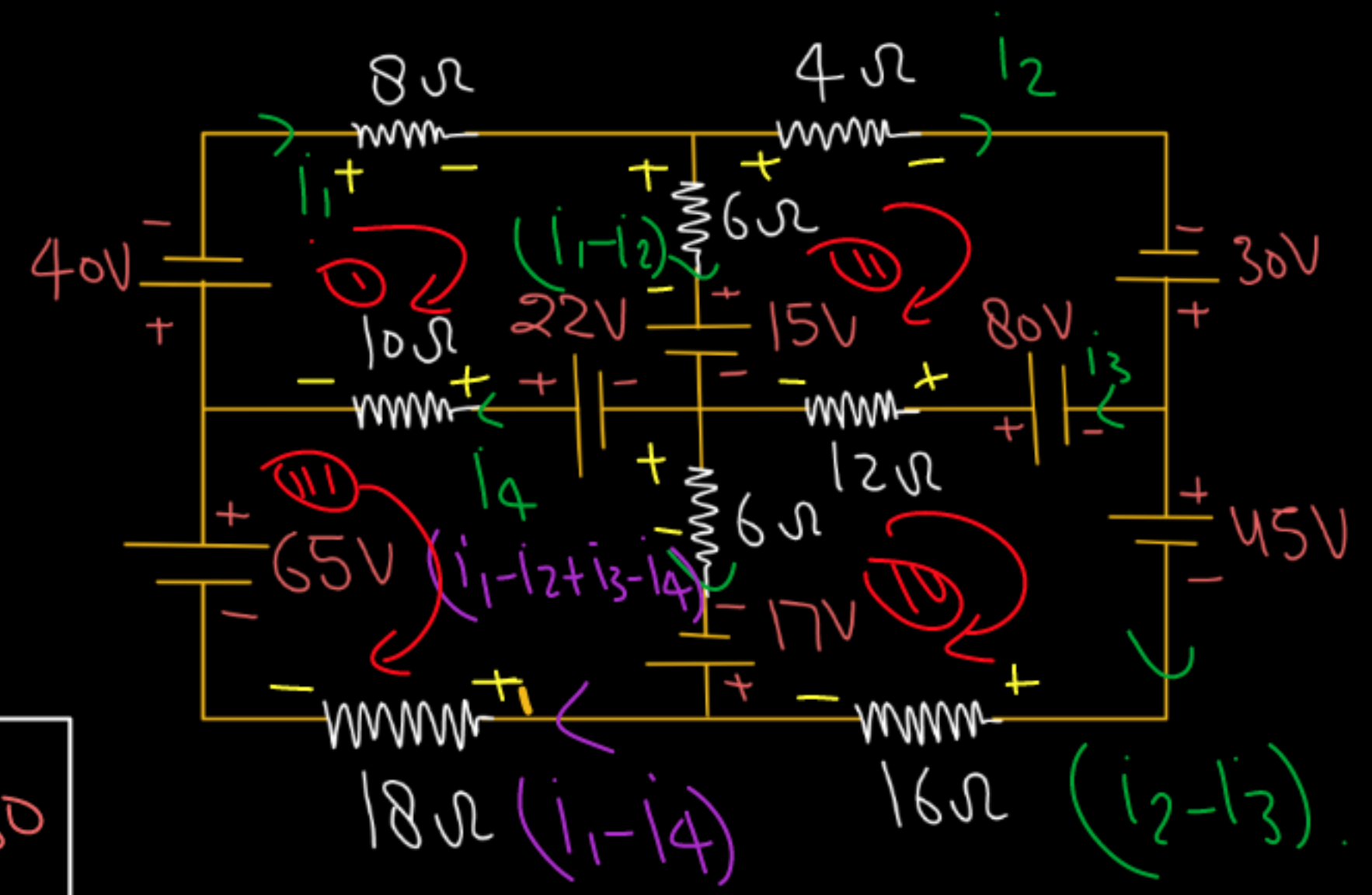
Branch Current method

KVL for mesh ①

$$40 + 8i_1 + 6(i_1 - i_2) + 15 - 22 + 10i_4 = 0 \quad \text{①}$$

KVL for mesh ②

$$-15 - 6(i_1 - i_2) + 4i_2 - 30 - 80 + 15i_3 = 0 \quad \text{②}$$



KVL for mesh ③

$$-65 - 10i_4 + 22 + 6(i_1 - i_2 + i_3 - i_4) - 17 + 18(i_1 - i_4) = 0 \quad \text{③}$$

KVL for mesh ④

$$-80 + 12i_3 + 6(i_1 - i_2 + i_3 - i_4) - 17 - 16(i_2 - i_3) - 45 = 0 \quad \text{④}$$

④

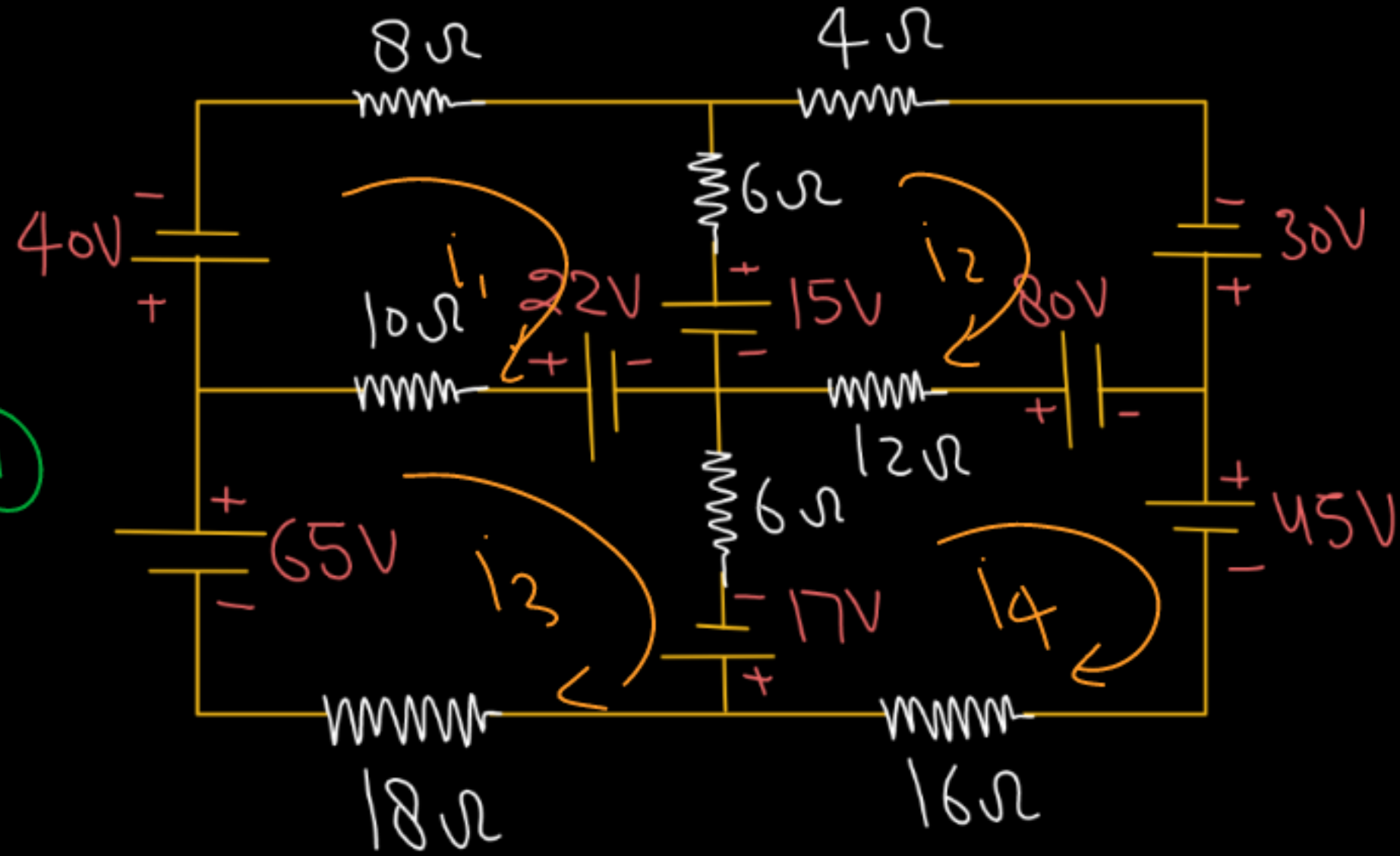
(Mesh/loop) Current method

mesh ①

$$[24i_1 - 6i_2 - 10i_3 = -33] \quad \text{①}$$

mesh ②

$$-6i_1 + 22i_2 - 12i_4 = 125 \quad \text{②}$$



$$-12i_2 - 6i_3 + 34i_4 = -142 \quad \text{③}$$

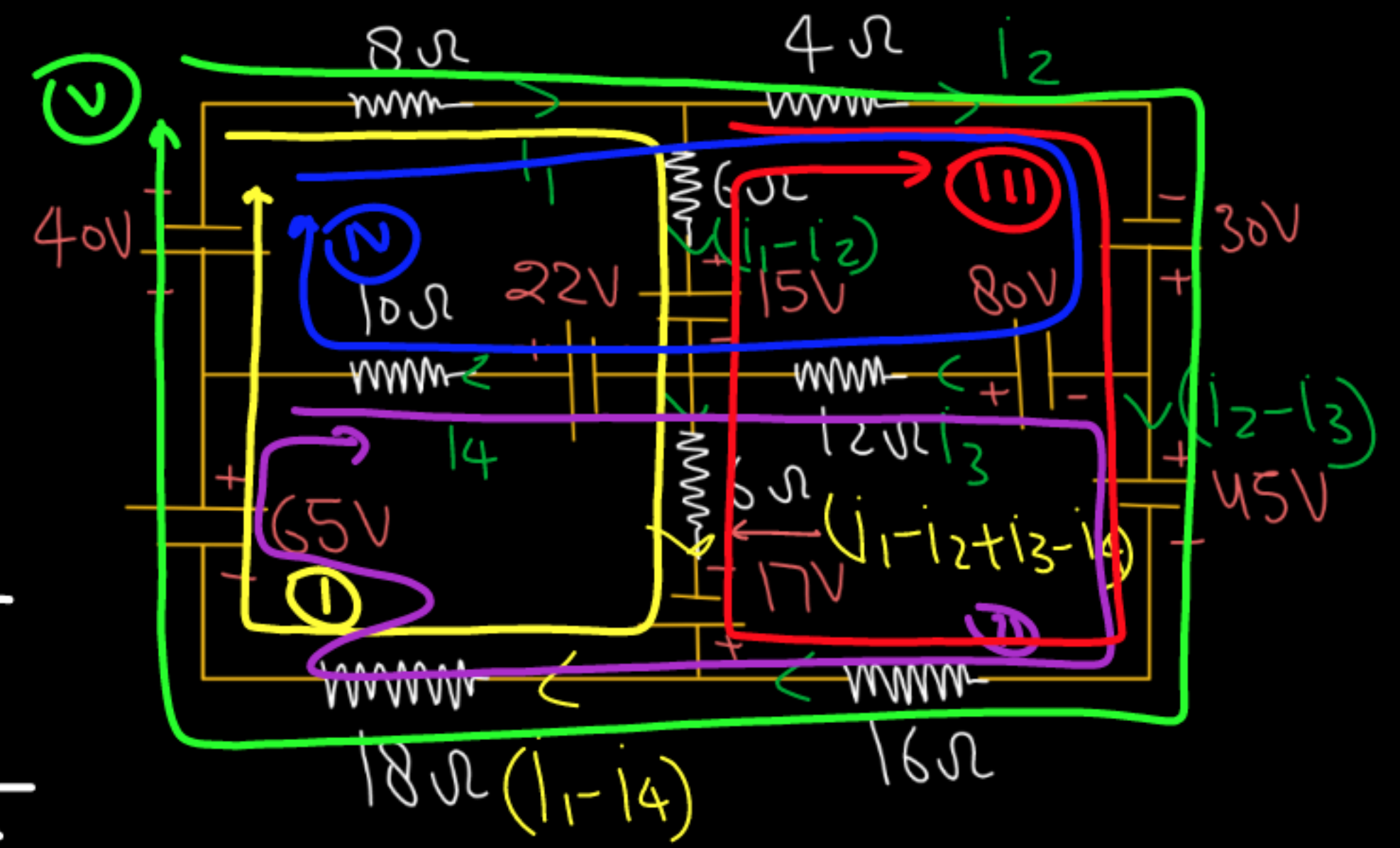
④

$$-10i_1 + 34i_3 - 6i_4 = 60 \quad \text{⑤}$$

method - 4:

Write down all possible loop eqns. not mesh eqns.

(Always follow branch-current method):-

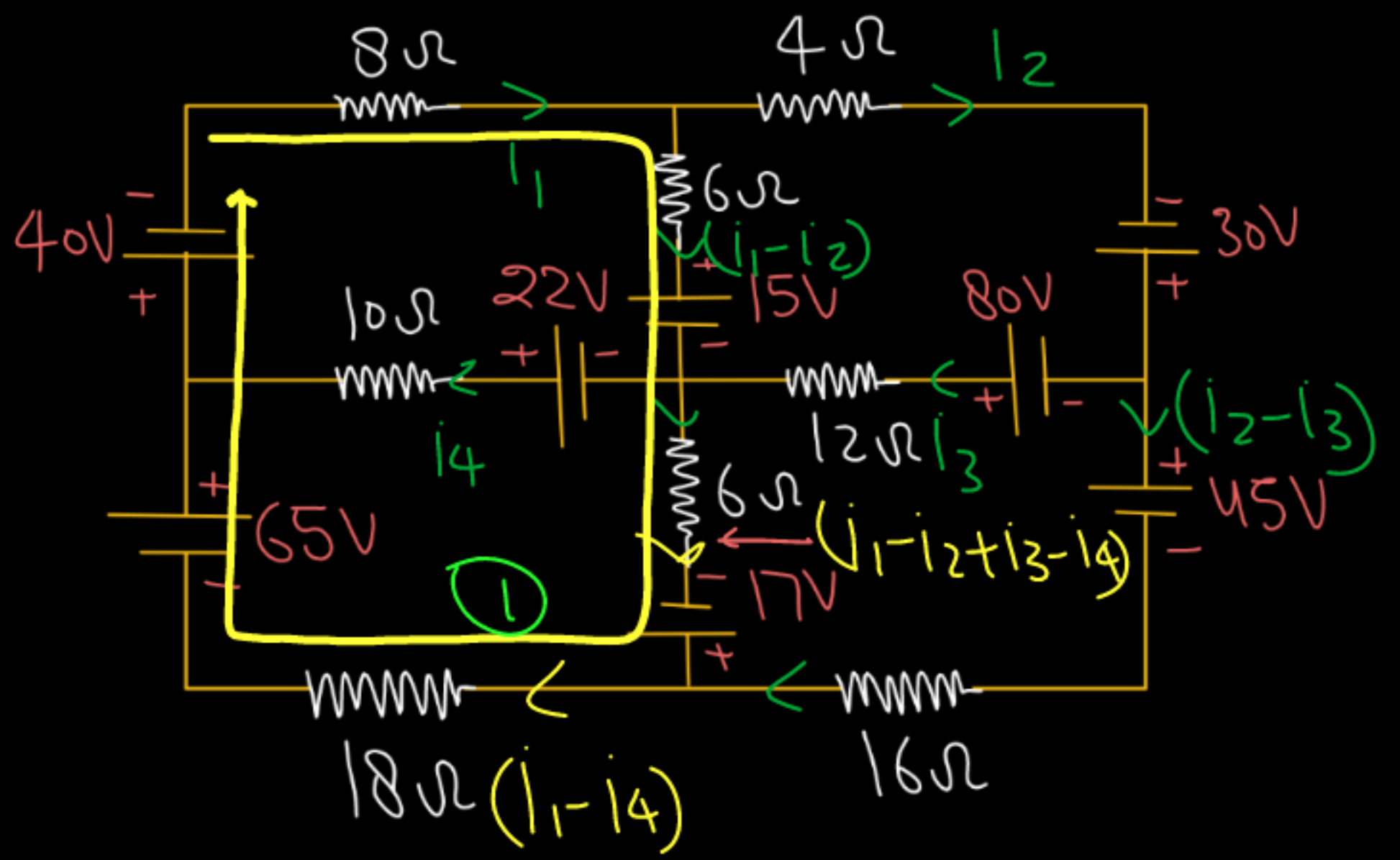


loop - I

$$-65 + 40 + 8i_1 + 6(i_1 - i_2) + 15$$

$$6(i_1 - i_2 + i_3 - i_4) - 17 +$$

$$18(i_1 - i_4) = 0 \quad \text{--- (1)}$$



Ex - draw electrical Circuit for given KVL Equations ?

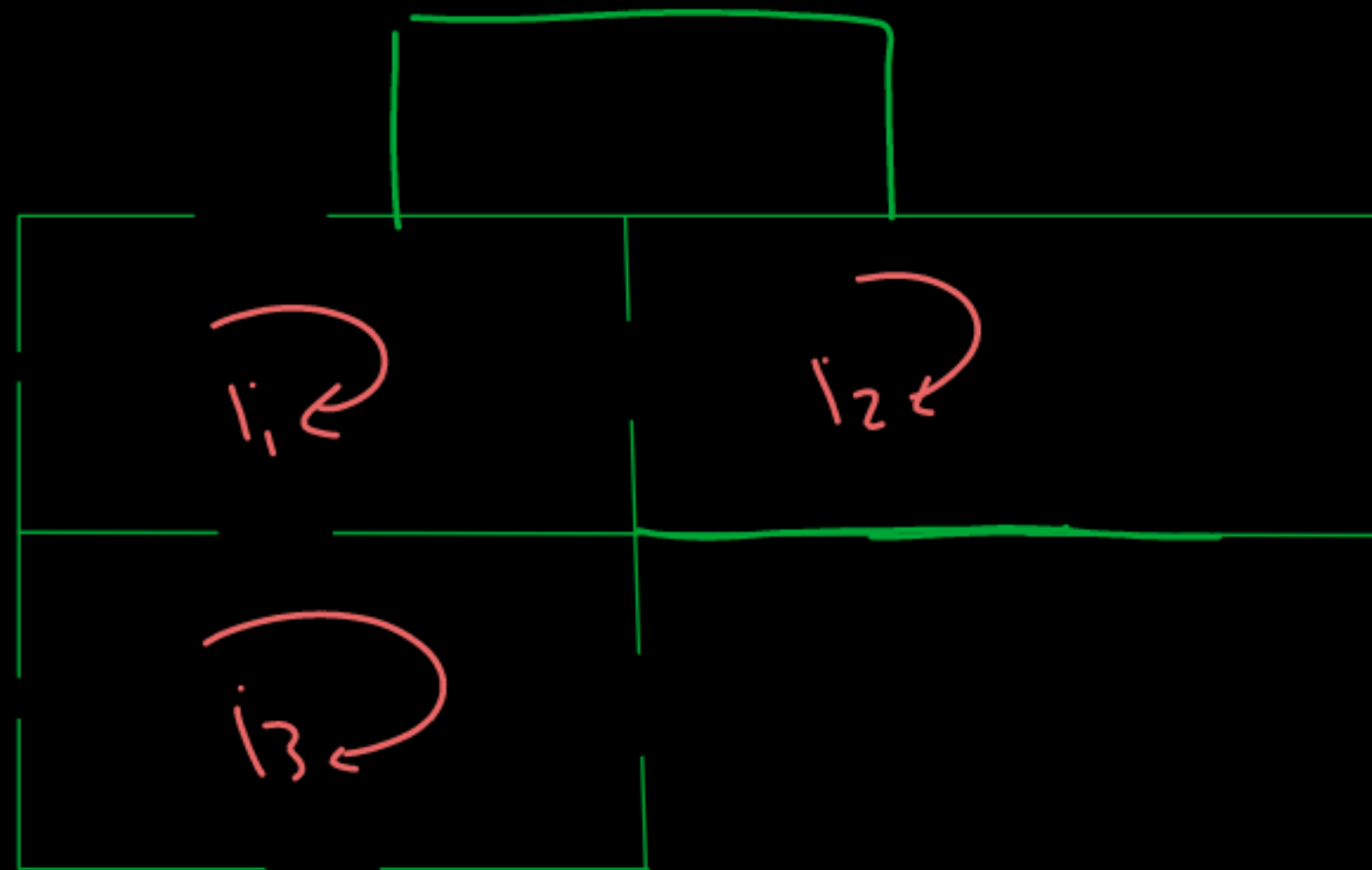
$$\Rightarrow 34i_1 - 10i_2 - 6i_3 - 4i_4 = -635 \quad \textcircled{I}$$

$$-10i_1 + 28i_2 - 6i_4 = 220 \quad \textcircled{II}$$

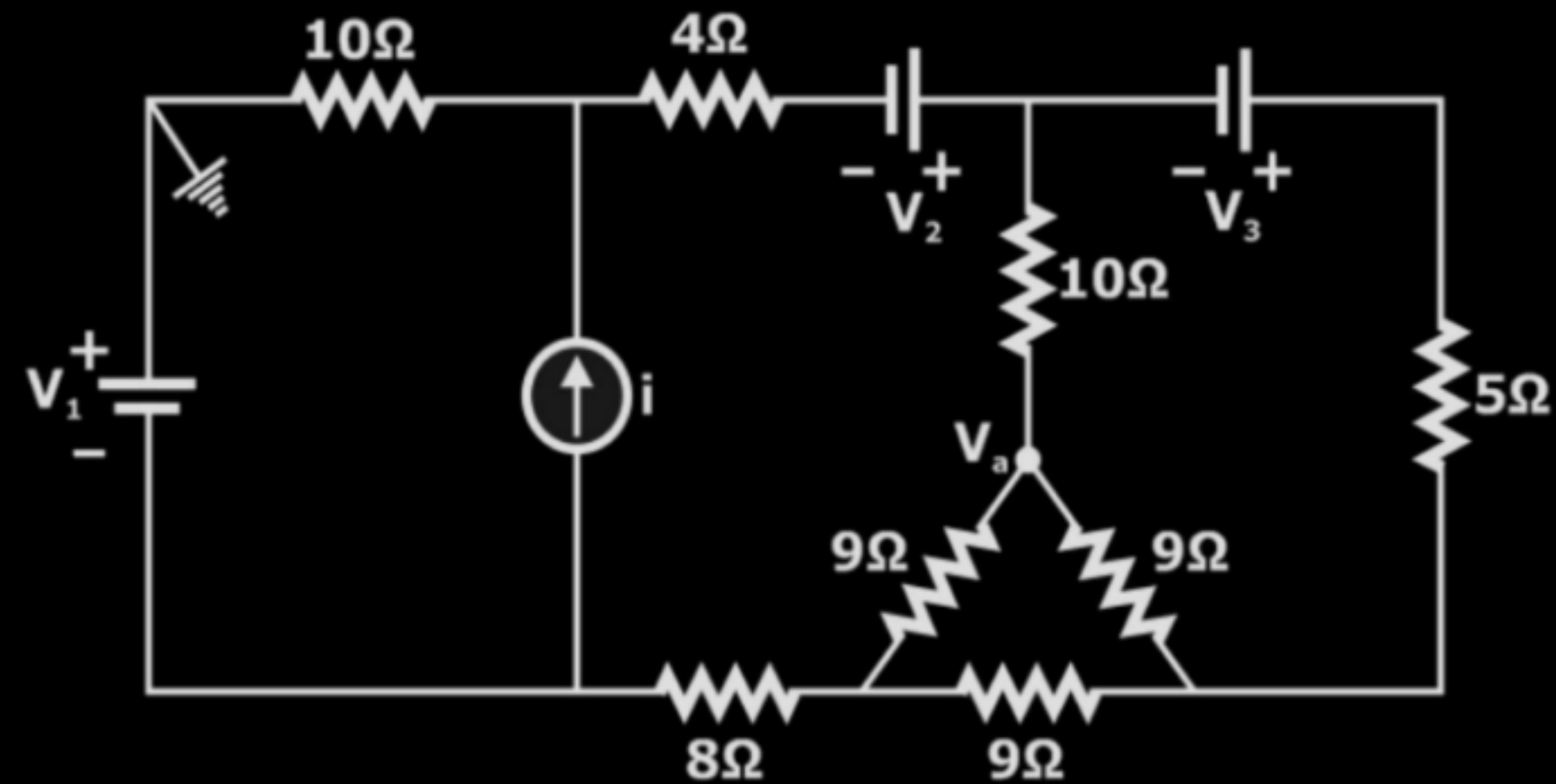
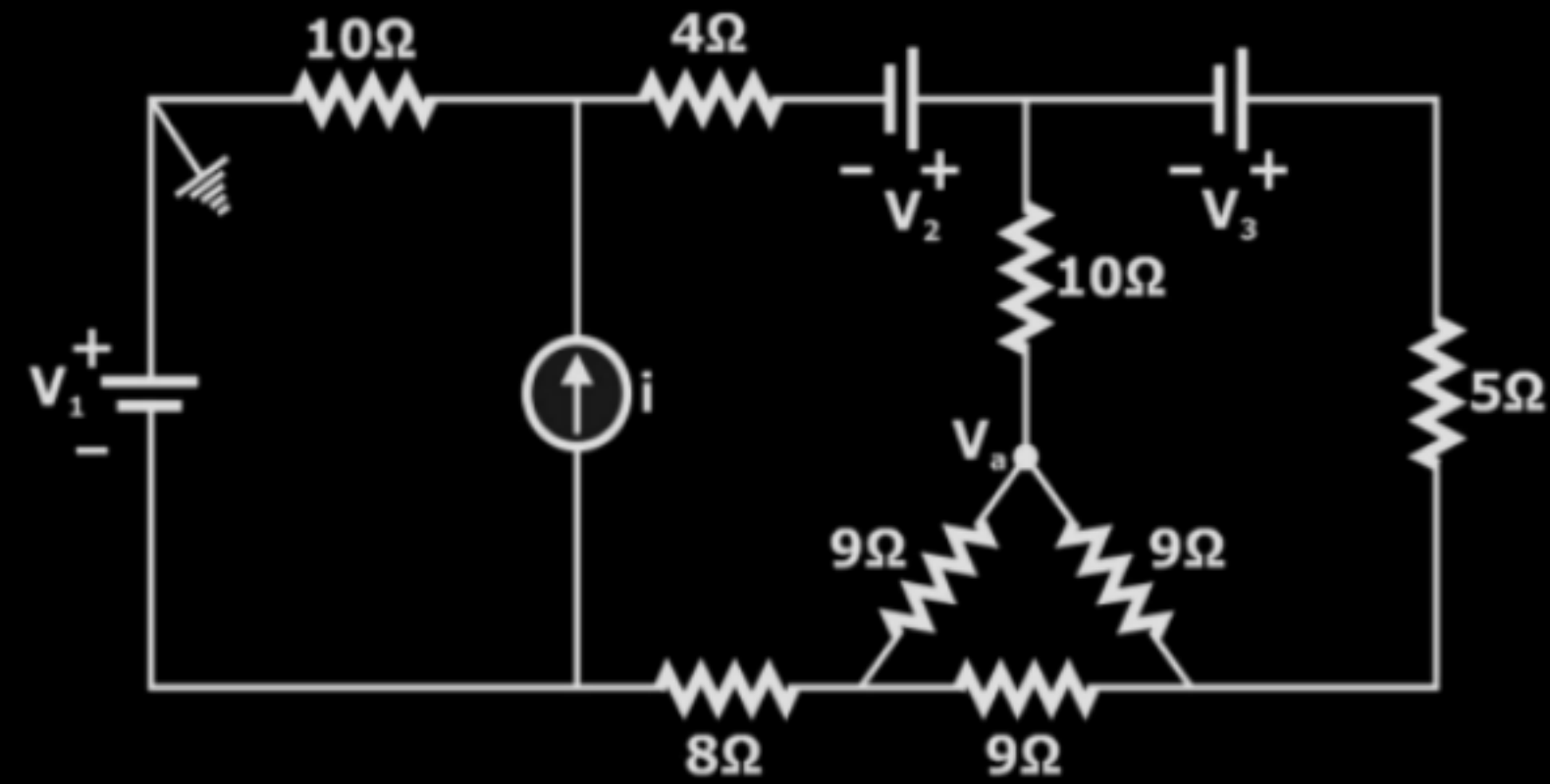
$$-6i_1 + 50i_3 = 60 \quad \textcircled{III}$$

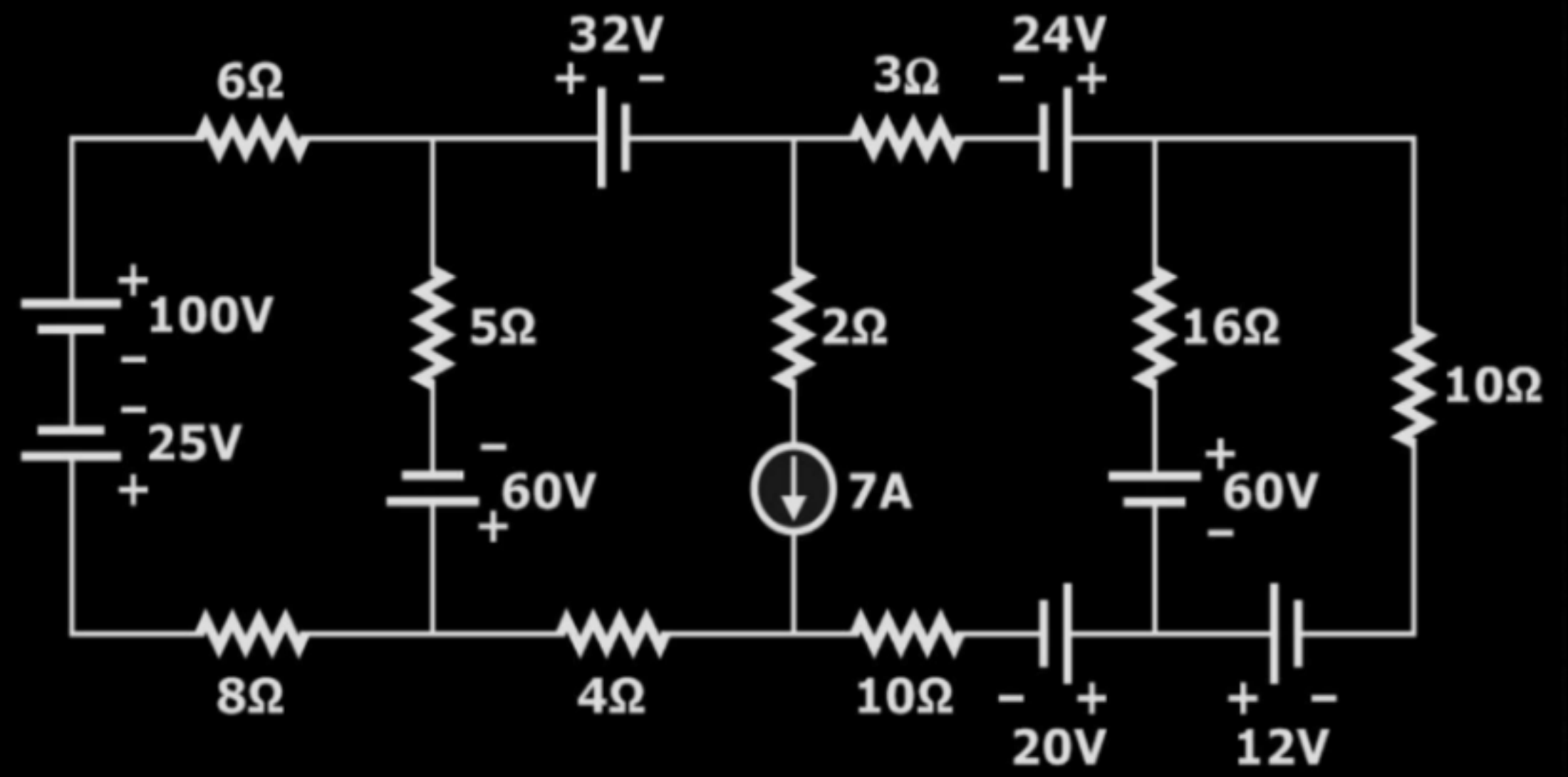
$$-4i_1 - 6i_2 + 27i_4 = -120 \quad \textcircled{IV}$$

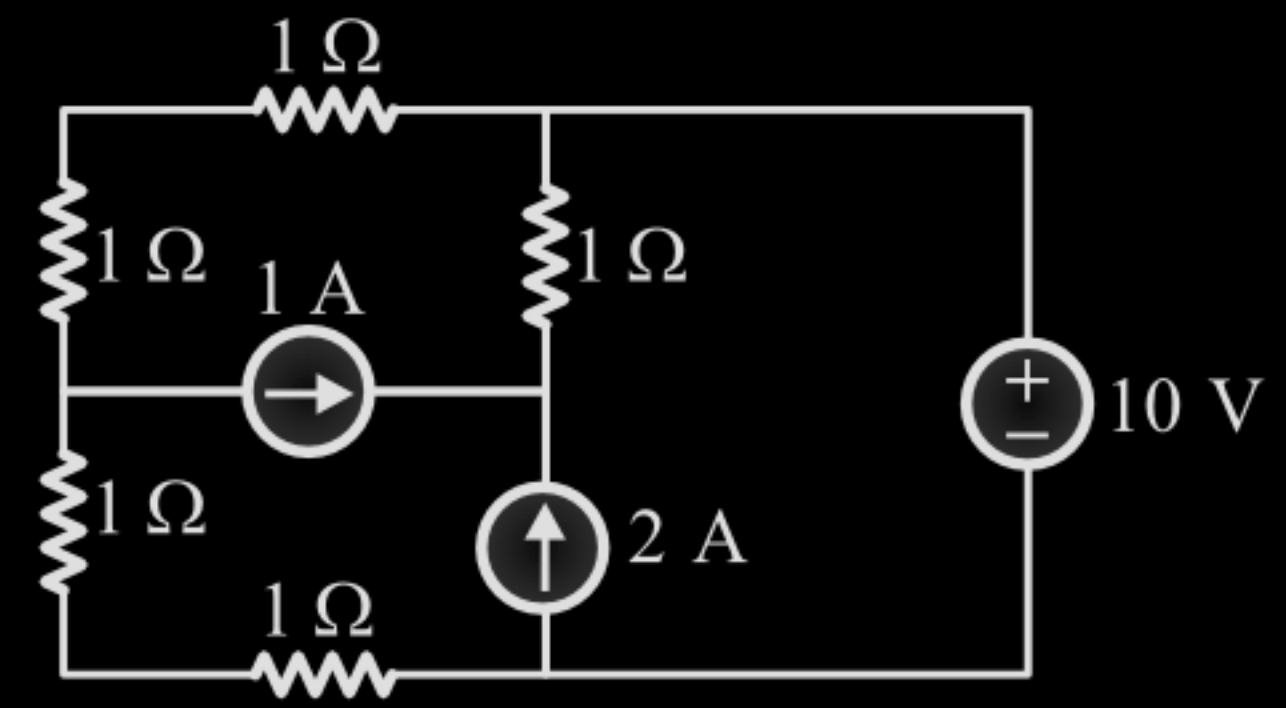
Soluⁿ: \rightarrow no. of variables = 4, So to design ckt, we need 4 meshes

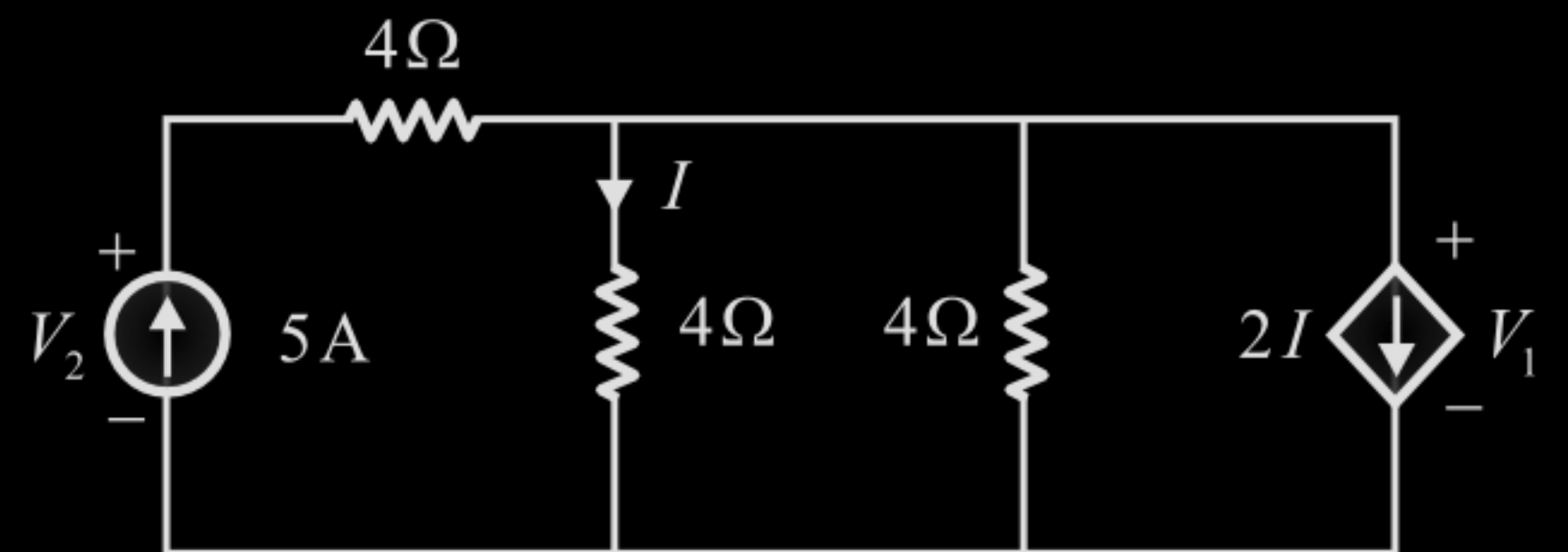


Ex. Write down all possible necessary KVL Equations .

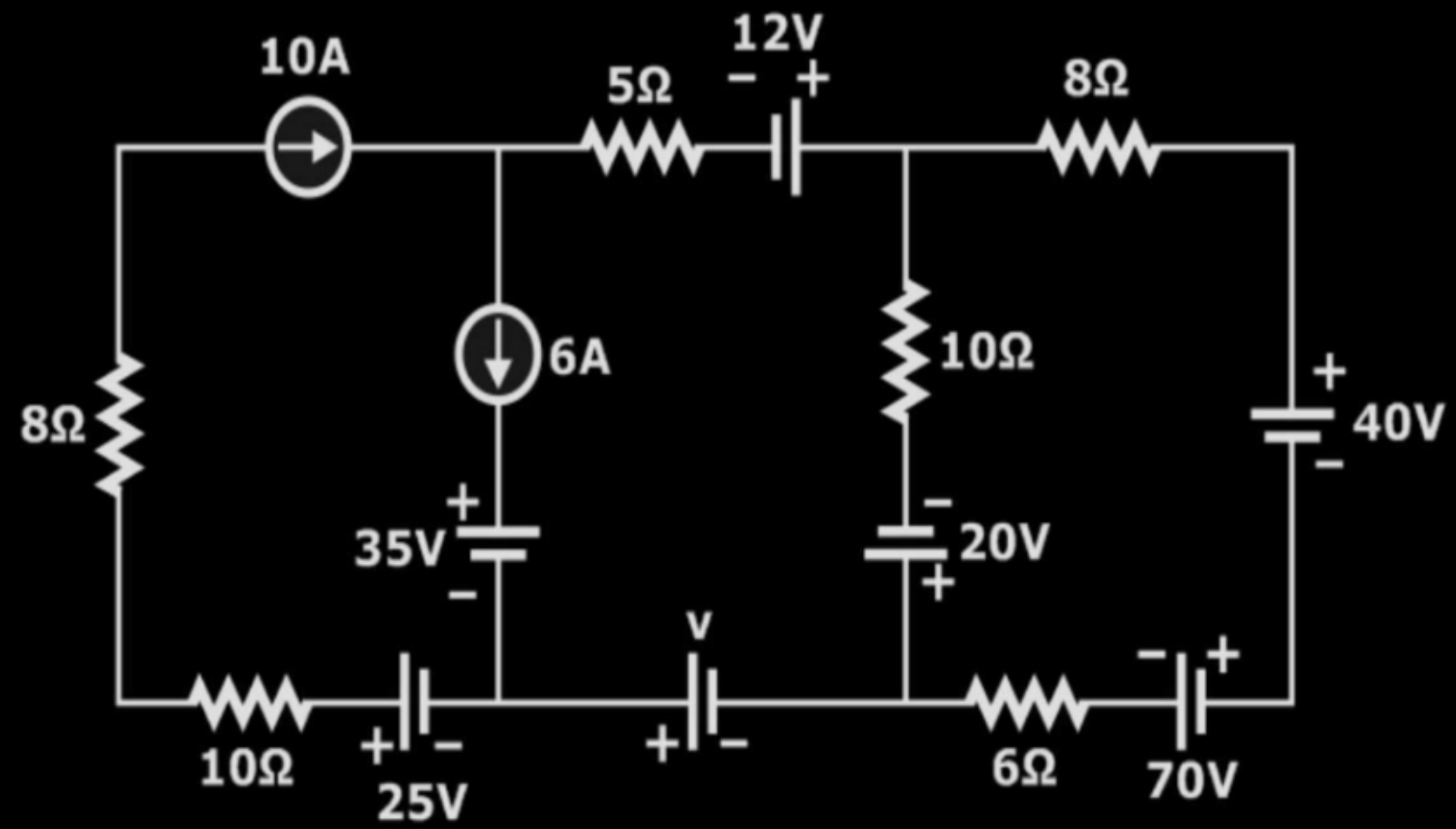


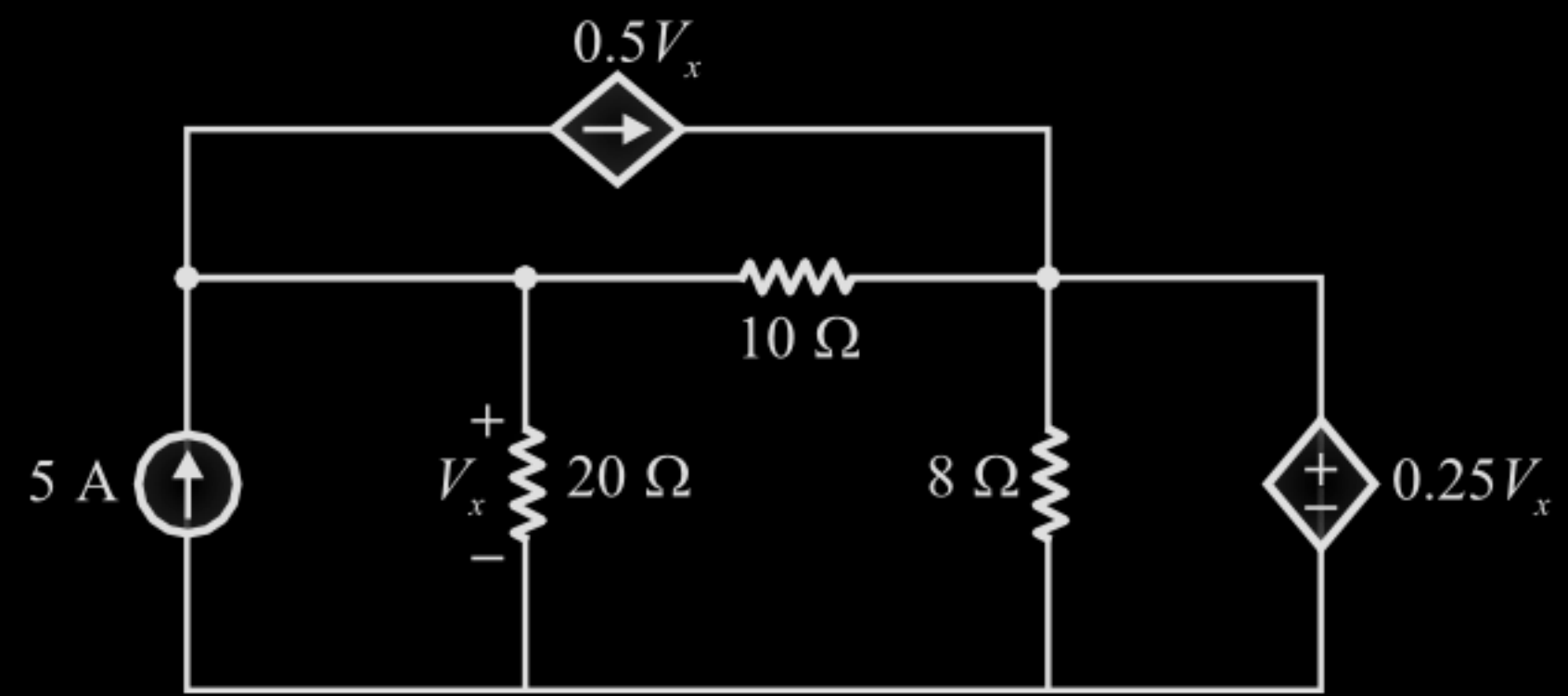






Super node analysis (SNA)





Super mesh analysis (SMA)

