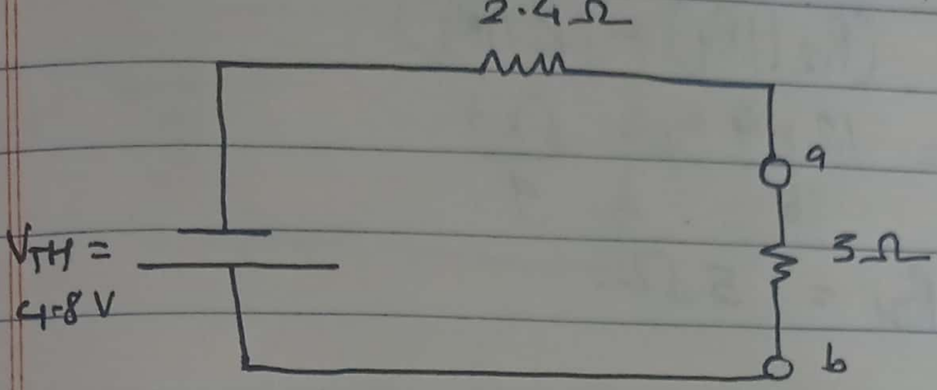
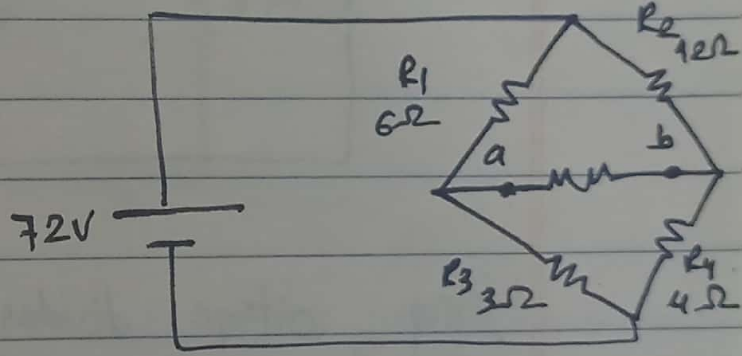
Using

Step: 5! V_{TH} and R_{TH}, drawing the equivalent Thevenin's circuit.

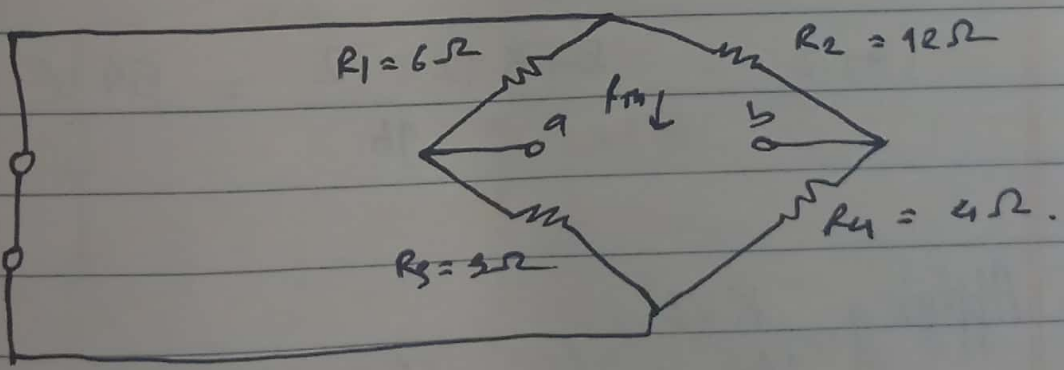


<Num. No. 53>: Find the Thevenin's equivalent circuit for the network between point a and b.



Soln.

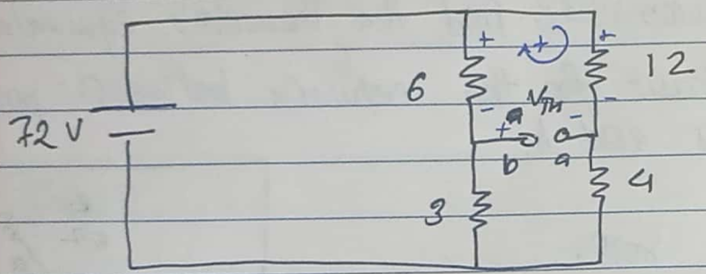
Step 1, 2



Now,

$$R_{TH} = (R_2 || R_4) + (R_1 || R_3)$$
$$= \frac{12 \times 4}{16} + \frac{6 \times 3}{9}$$
$$\therefore R_{TH} = 5\Omega.$$

Again,



Using voltage divider rule,

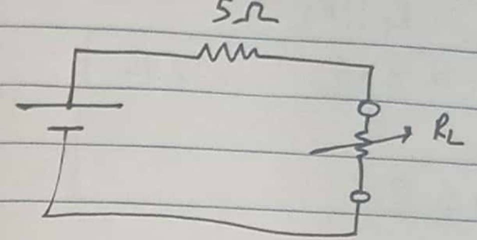
$$V_{6\Omega} = \frac{72 \times 6}{9} = 48\ V$$

$$V_{12\Omega} = \frac{\cancel{54\times}\ 12 \times 72}{16} = 54\ V$$

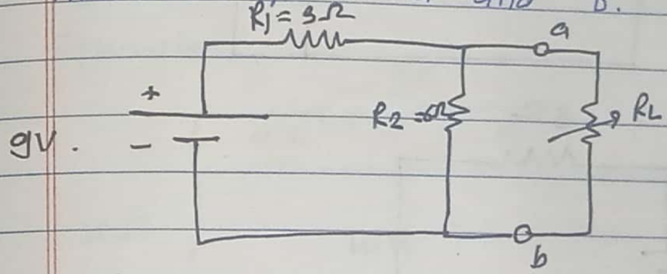
Applying KVL,

$$V_{TH} + V_{6\Omega} - V_{12} = 0$$
$$\therefore V_{TH} = 6\ V.$$

The equivalent ~~circ~~ Thevenin's circuit is

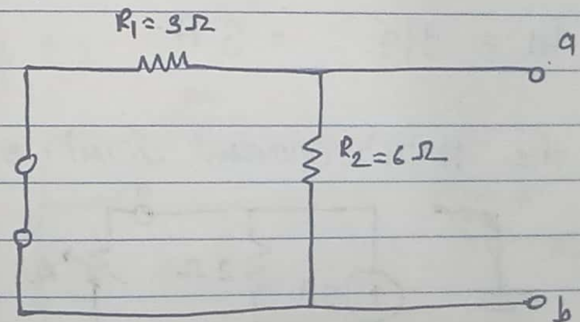


<Num. No 54>: Find the Norton's equivalent circuit for the network between marked point a and b.



Soln:

Step 1, 2:



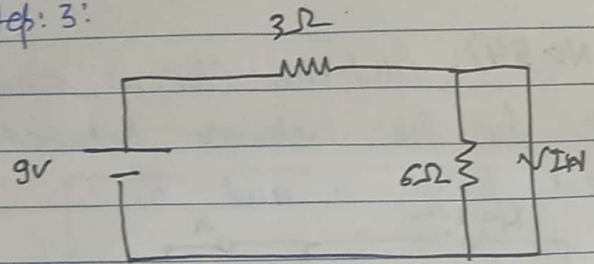
Now

$R_N = R_1 || R_2$

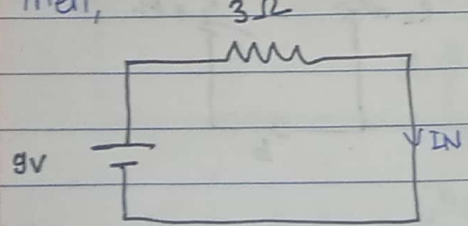
$= \frac{3 \times 6}{9} = 2\,\Omega$

$\therefore R_N = 2\,\Omega$

Step: 3:

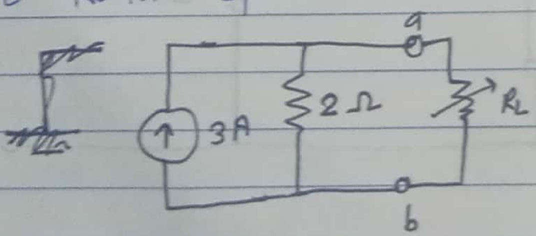


Then,

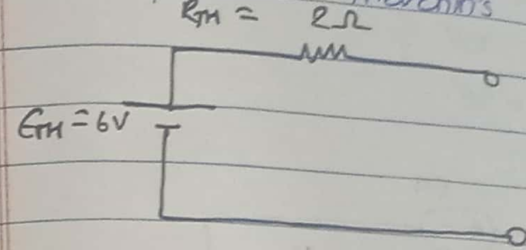


$I_N = 9/3 = 3\ A.$

So the Norton's equivalent circuit is

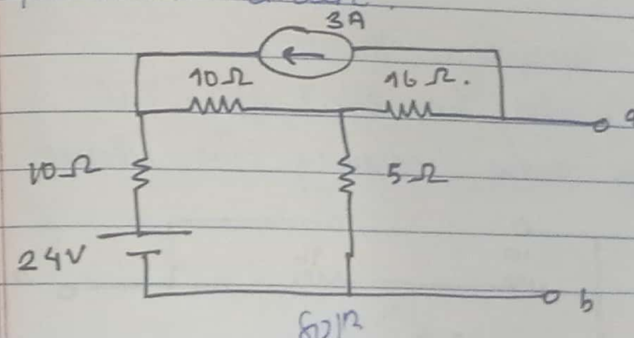


The equivalent Thevenin's circuit is,

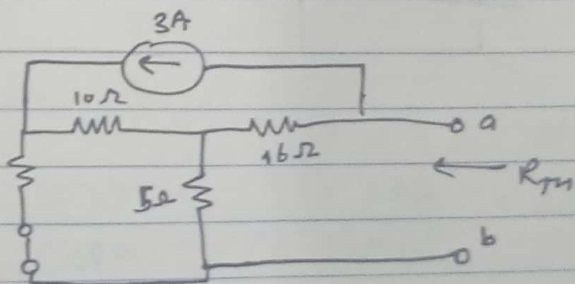


$E_{TH} = 3 \times 2$
$= 6V$

⟨Num. No. 55⟩: Obtained the Thevenin's equivalent of terminal a-b of the circuit and convert it into Norton's equivalent circuit.



Step 1, 2:

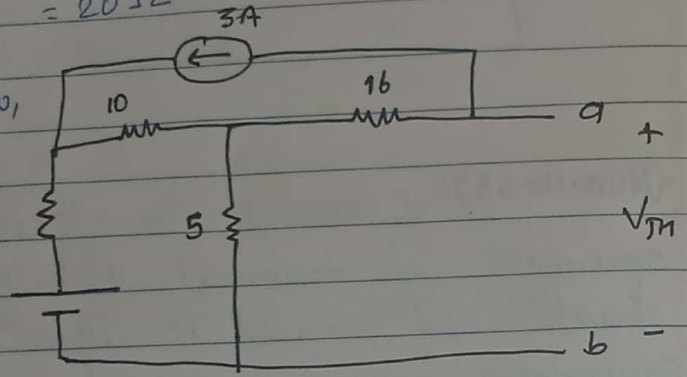


$R_{TH} = \{(10+10)\parallel 5\} + 16$

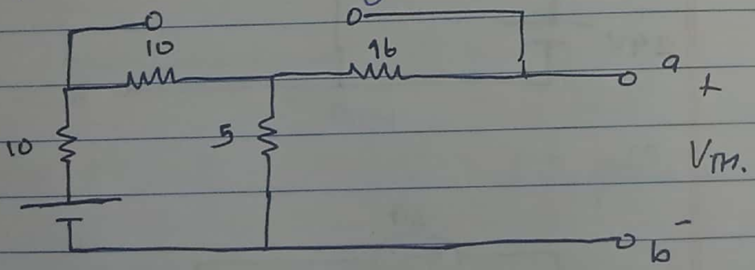
$= \frac{\cancel{20}^{\,4}\times\cancel{5}}{\cancel{25}_{\,5}} + 16$

$= 20\,\Omega$

Now,



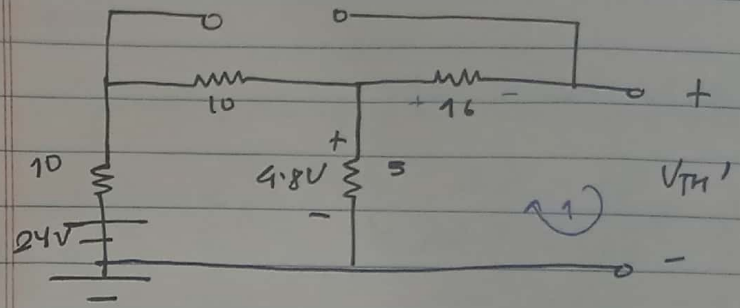
Using superposition theorem,
Consider the effect of 24 V voltage source, redrawing the circuit,



Now,

$V_{5\Omega} = \frac{24\times 5}{(10+10\parallel 5)} = \frac{24\times 5}{25} = 4.8\ V$

Redrawing the circuit,

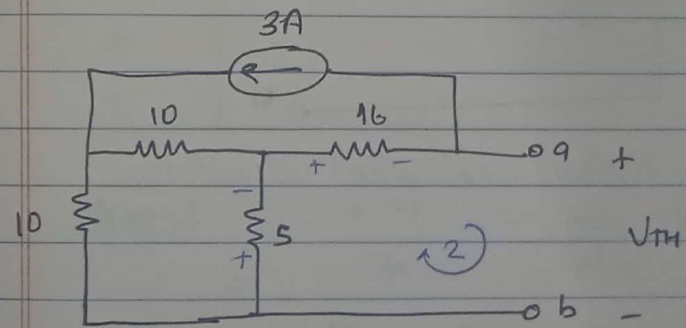


In loop 1,

$V_5 - V_{16} - V_{TH}'$

$\therefore V_{TH}' = -4.8\ V$

Considering the effect of 3A current, redrawing the circuit,



Now, using current divider rule,

$I_{5\Omega} = \frac{10\times 3}{25} = 1.2\ A$

$\therefore V_{5\Omega} = 5\times 1.2 = 6V$

and $V_{16\Omega} = I \times R_{16}$
$= 48$ V.

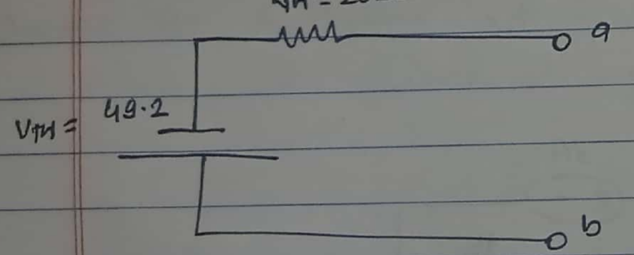
Applying KVL in loop ^

$$-V_{5\Omega} - V_{16\Omega} - V_{TH}'' = 0$$
$$\therefore V_{TH}'' = -54 \text{ V}$$

Now,

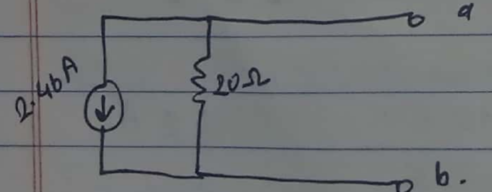
$$V_{TH} = V_{TH}' + V_{TH}'' = 4.8 - 54 = -49.2 \text{ V.}$$

Thus, the thevenin's equivalent circuit is,

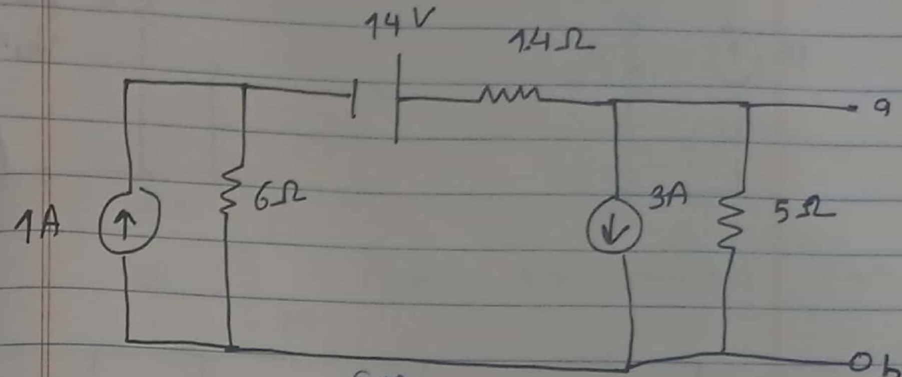


The Norton's equivalent circuit is,

$$I_N = \frac{V_{TH}}{R_{TH}} = \frac{49.2}{20} = 2.46\text{ A.}$$

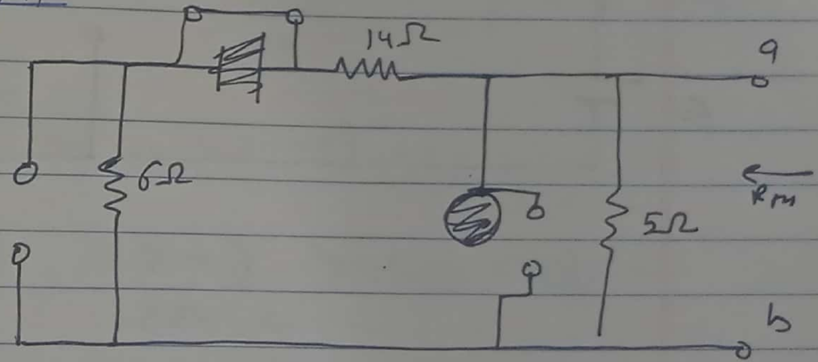


<Num.No.56>. Find the Thevenin's and Norton's equivalent circuit terminals a-b.



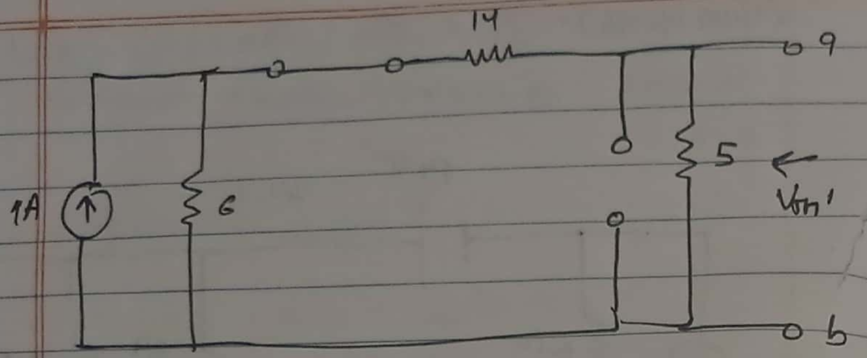
Soln.

Step 1/2:

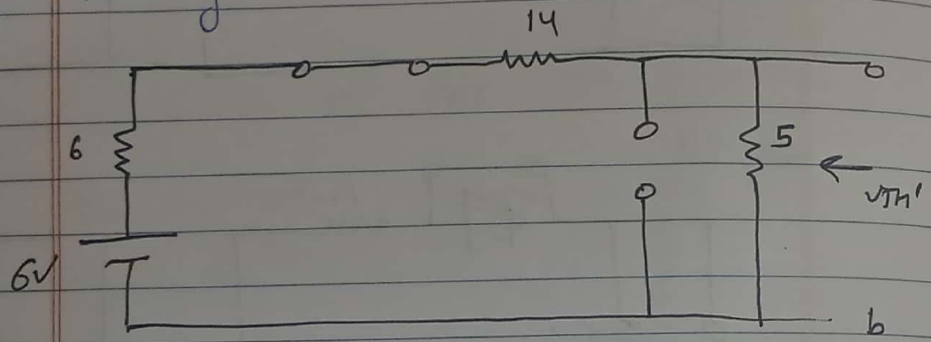


$$R_{TH} = (6+14) \parallel 5 = \frac{20 \times 5}{25} = 4\Omega$$

Considering 1A current,

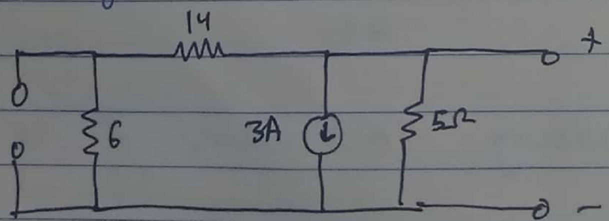


Redrawing the circuit,



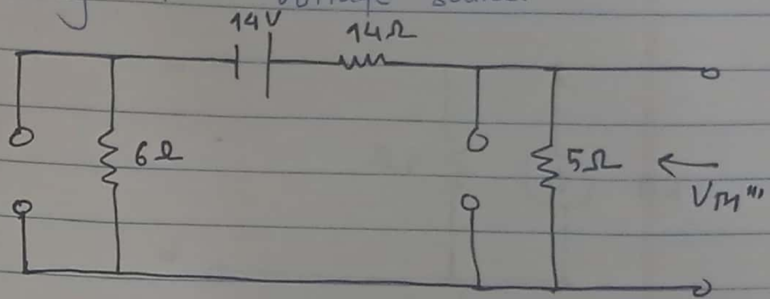
$$V_{5\Omega} = V_{TH}' = \frac{6 \times \cancel{5}}{\cancel{25}\ 5} = 1.2\,V$$

Considering 3A current source,



$$V_{5\Omega} = V_{TH}'' = \frac{\overset{20}{\cancel{5}} \times (3\times5)}{25} = -12\,V$$

Considering 14 V voltage source.

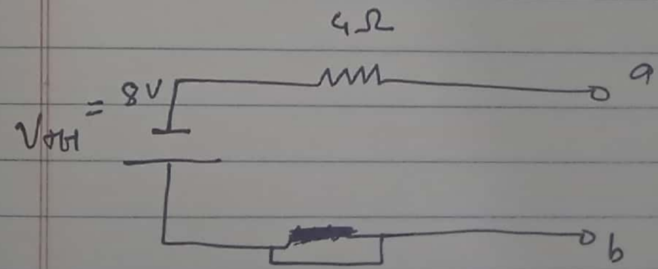


$$V_{5\Omega} = \frac{5\times14}{25} = 2.8\,V = V_{TH}'''$$

So,

$$V_{TH} = 1.2 - 12 + 2.8 = -8\,V.$$

The equivalent Thevenin's circuit is,



The equivalent Norton's circuit is,

$$I_N = \frac{8}{4} = 2A.$$

$$R_N = R_{TH} = 4\Omega$$