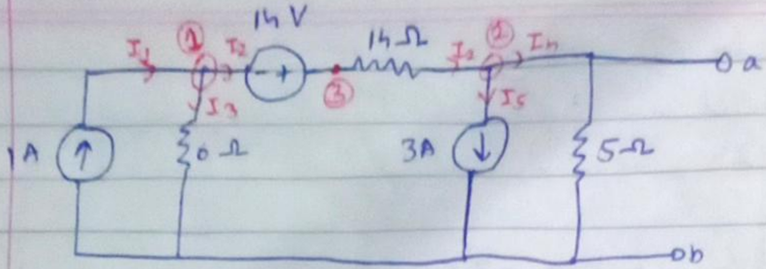
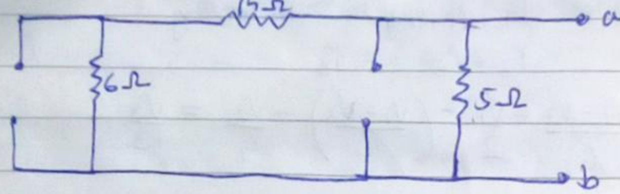
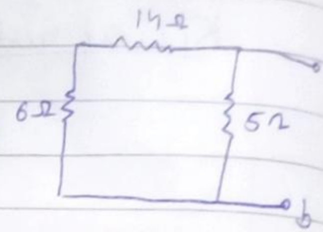
Q4

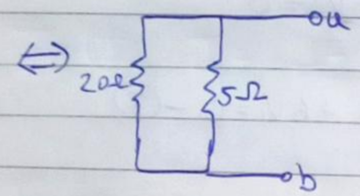


i) Equivalent Resistance (R_{TH})

Make all independent sources zero







$\Rightarrow R_{TH} = \left(\frac{1}{5} + \frac{1}{20}\right)^{-1}$

$\Rightarrow \boxed{R_{TH} = 4\,\Omega}$

ii) V_{TH} :

KCL at (2) $\Rightarrow I_2 = I_4 + I_5$

$\Rightarrow I_2 = \frac{V_2}{5} + 3$ — (1)

KCL at (1) $\Rightarrow I_1 = I_2 + I_3$

$\Rightarrow I_2 = I_1 - I_3$

$\Rightarrow I_2 = 1 - \frac{V_1}{6}$ — (2)

From (1) and (2)

$\frac{V_2}{5} + 3 = 1 - \frac{V_1}{6}$

$\Rightarrow 5V_1 + 6V_2 = -60$ — (1)

$V_3 - V_1 = 14V$ — (2)

KCL at 3 $\Rightarrow I_2 = \dfrac{V_3 - V_2}{14}$ — 3

From 2 and 3

$$\frac{V_3 - V_2}{14} = 1 - \frac{V_1}{6}$$

$$6V_3 - 6V_2 + 14V_1 = 84$$

$$\Rightarrow 3V_3 - 3V_2 + 7V_1 = 42 \quad — (4)$$

Put 2 in 1 and 4

$$5V_1 + 6V_2 = -60$$

$$10V_1 - 3V_2 = 0$$

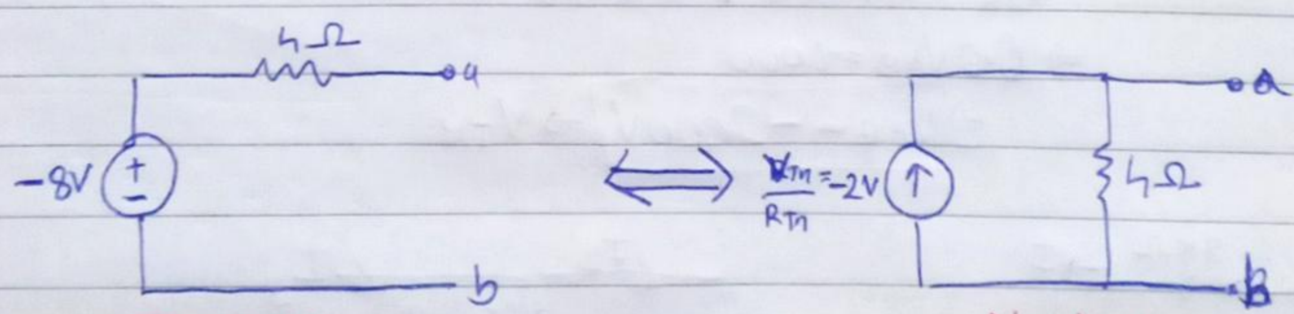
$$\Rightarrow \quad 5V_1 + 6V_2 = -60$$

$$\underline{20V_1 - 6V_2 = 0}$$

$$25V_1 \qquad = -60$$

$$\Rightarrow V_1 = -2.4 \Rightarrow \boxed{V_2 = -8}$$

$V_2 = \boxed{V_{TH} = -8V}$



Thenivin's Equivalent

Norton's Equivalent