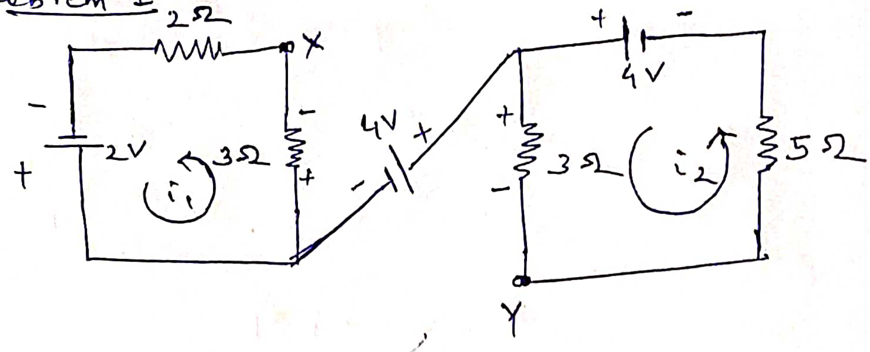
Problem-1

(1)



$i_1 = \frac{2}{5}\,A$, $i_2 = \frac{1}{2}\,A$.

Applying KVL

$$-V_x - 3\left(\frac{2}{5}\right) - 4 + 3\left(\frac{1}{2}\right) + V_y = 0$$

$$V_x - V_y = -\frac{6}{5} - 4 + \frac{3}{2}$$

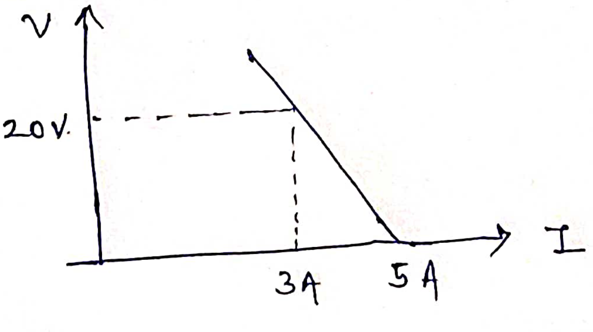
$$V_{xy} = \frac{-12-40+15}{10} = \frac{-52+15}{10} = \frac{-37}{10} = -3.7V$$

(2) $R_{xy} = \infty$.

$$i_{xy} = \frac{-3.7V}{\infty} = 0A .$$

Problem - 2

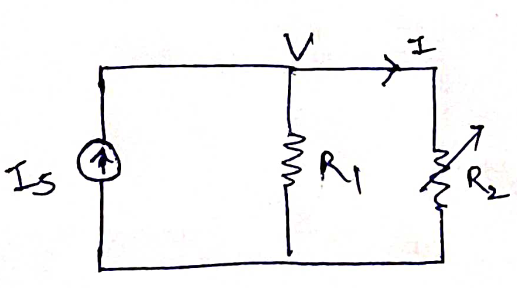
(1)



Given

$V = 0V$, $I = 5A$ ⟹ Current Source.

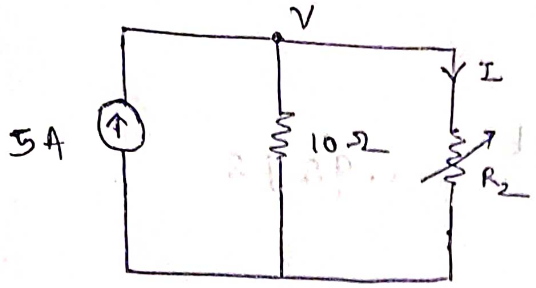
$V = 20V$, $I = 3A$ ⟹ Resistive network.



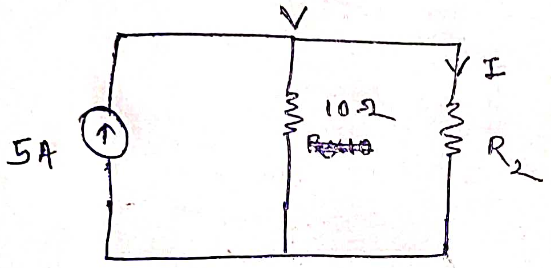
$V = 0,\ I = 5A \Rightarrow R_2 = 0\Omega$

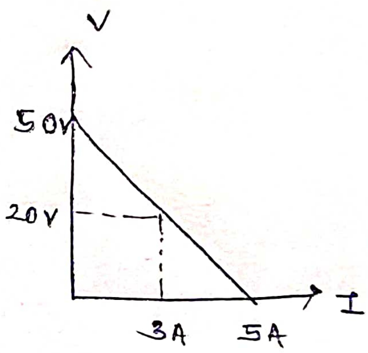
at $V = 20,\ I = 3A \Rightarrow R_2 = \frac{20}{3},\ R_1 = \frac{20}{2} = 10\Omega$

The required circuit is



(2) R_2 can go from 0 to ∞.

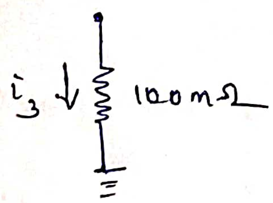




at $R_2 = 0$, $V = 0V$, $I = 5A$.

at $R_2 = \infty$, $V = 50V$, $I = 0A$.

Problem - 3



$$V = i_3 (100m\Omega)$$

$$= 2e^{-3t}(100m)$$

$$V = 0.2e^{-3t}.$$

$$V = L\frac{di}{dt} \Rightarrow i_L(t) = \frac{1}{L}\int v\,dt.$$

$$\Rightarrow i_L(t) = \frac{1}{L} \times 0.2 \int e^{-3t}\,dt.$$

$$\Rightarrow i_L(t) = \frac{1}{0.1} \times 0.2 \times \frac{e^{-3t}}{-3} + c$$

$$\Rightarrow i_L(t) = -\frac{2}{3}e^{-3t} + c$$

$i_L(-0.5) = 1A.$

at $t = -0.5$, $i = 1A.$

$1 = -2.9878 + c.$

$c = 3.9878.$

$\therefore i_L(t) = -\frac{2}{3}e^{-3t} + 3.9878$