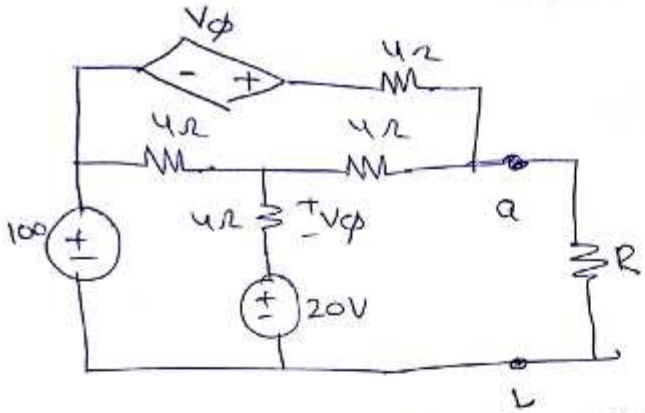
Answer



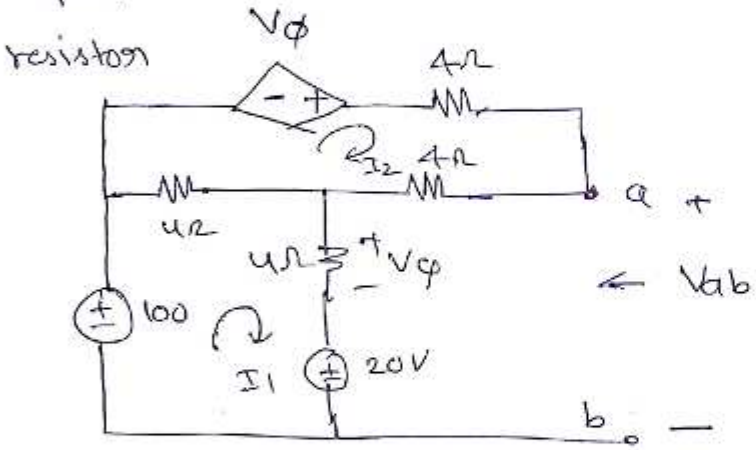
we have to calculate the value of R as thevenins resistance

where Thevenin's Resistance $R_{Th} = \frac{V_{oc}}{I_{sc}}$

V_{oc} - open circuit voltage

I_{sc} - short circuit current

open the resistor and calculate the voltage across the resistor



Apply mesh analysis

$$-100 + 4(I_1 - I_2) + 4I_1 + 20 = 0$$

$$8I_1 - 4I_2 = 80$$

$$2I_1 - I_2 = 20 \rightarrow (1)$$

and loop 2

$$4(I_2 - I_1) - V\varphi + 4I_2 + 4I_2 = 0$$

and $V\varphi = 4I_1$

$$\Rightarrow 4I_2 - 4I_1 - 4I_1 + 4I_2 + 4I_2 = 0$$

$$I_2 - I_1 - I_1 + I_2 + I_2 = 0$$

by solving equ (1) & (2) we get

$I_1 = 15A$

$I_2 = 10A$

$$3I_2 - 2I_1 = 0 \rightarrow (2)$$

$-Vab + 4\Omega I_2 + 4I_1 + 20 = 0$

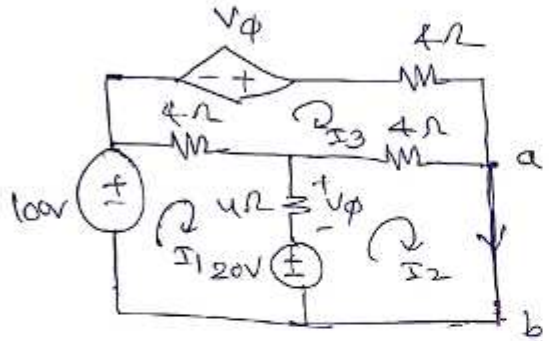
$Vab = 4I_2 + 4I_1 + 20$

$= 4 \times 10 + 4 \times 15 + 20 = 40 + 60 + 20$

$= 160 + 120 + 20 \quad = 120V$

$\boxed{Vab = 120\ V}$

make short circuit between ab and calculate I_{sc} (short circuit current)



Apply mesh analysis

$-100 + 4(I_1 - I_3) + 4(I_1 - I_2) + 20 = 0$

$-100 + 8I_1 - 4I_2 - 4I_3 + 20 = 0$

$8I_1 - 4I_2 - 4I_3 = 80$

$2I_1 - I_2 - I_3 = 20 \rightarrow (1)$

$-20 + 4(I_2 - I_1) + 4(I_2 - I_3) = 0$

$-5 + I_2 - I_1 + I_2 - I_3 = 0 \Rightarrow \quad 2I_2 - I_1 - I_3 = 5 \rightarrow (2)$

$4(I_3 - I_1) - V\phi + 4I_3 + 4(I_3 - I_2) = 0$

where $V\phi = (I_1 - I_2)4$

$4(I_3 - I_1) - 4(I_1 - I_2) + 4I_3 + 4(I_3 - I_2) = 0$

$I_3 - I_1 - I_1 + I_2 + I_3 + I_3 - I_2 = 0$

$3I_3 - 2I_1 = 0 \rightarrow (3)$

by solving equations (1) & (2) & (3) we get

$I_1 = 45, \quad I_2 = 40, \quad I_3 = 30$

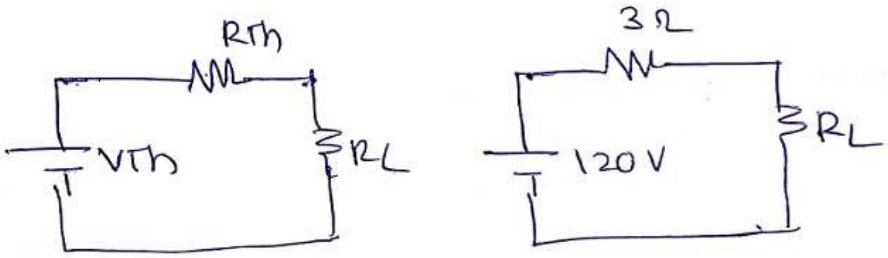
Here short circuit current $I_{sc} = 40A = I_2$

so $R_{Th} = \frac{300}{40} = 7.5\Omega$

$R_{Th} = \frac{V_{OC}}{} = \frac{120V}{} - 3\Omega$

Isc 40A

The equivalent circuit becomes



maximum power transfer when $R_L = R_{Th} = 3\Omega$

(b) maximum power transfer = $\frac{(V_{Th})^2}{4 \times R_{Th}} = P_{max}$

$$= \frac{(120)^2}{4 \times 3}$$

$P_{max} = 1200\,W$

$P_{max} = 1.2\,KW$

Likes: 3 **Dislikes: 0**