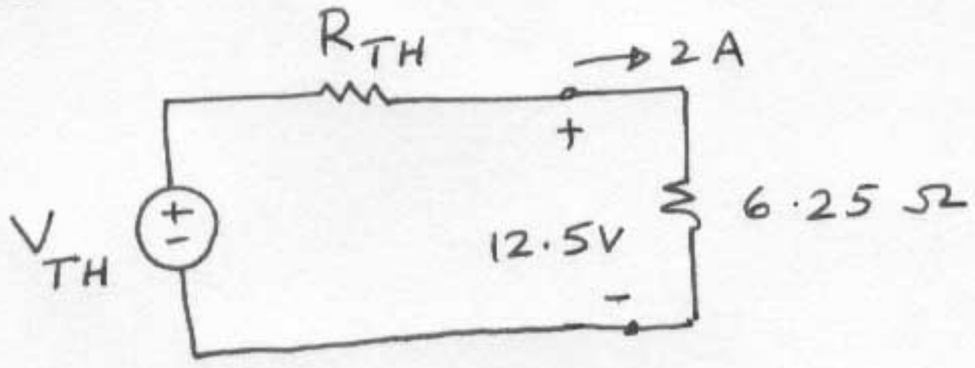
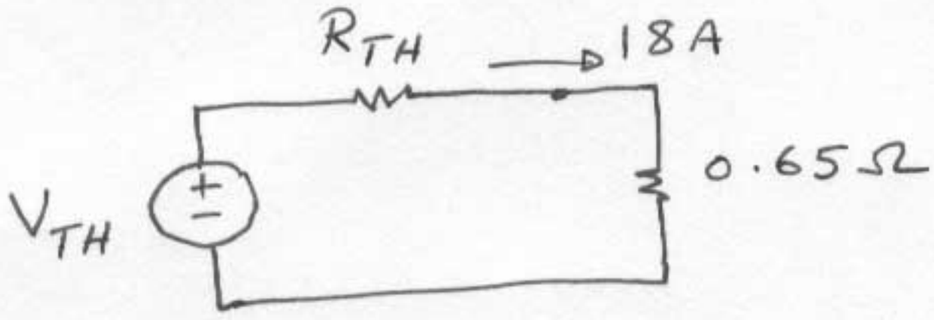
P 4.55



$$12.5 = V_{TH} - 2R_{TH} \quad (1)$$

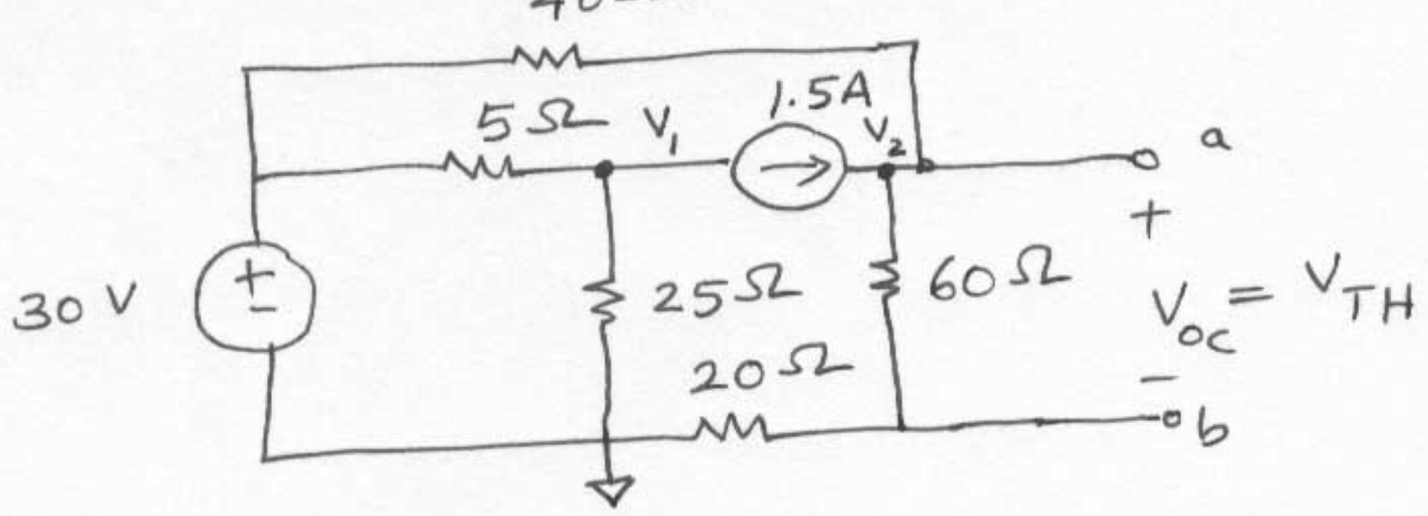


$$11.7 = V_{TH} - 18R_{TH} \quad (2)$$

Solving (1) & (2) $\Rightarrow V_{TH} = 12.6\ V$, $R_{TH} = 50\ m\Omega$.

$\therefore I_N = 252\ A$, $R_N = 50\ m\Omega$.

P 4.58 a)



open circuit

$$\frac{V_2}{80} + \frac{V_2 - 30}{40} - 1.5 = 0 \Rightarrow V_2 = 60\ V$$

But $V_{oc} = \frac{60}{80} V_2$ (VDR)

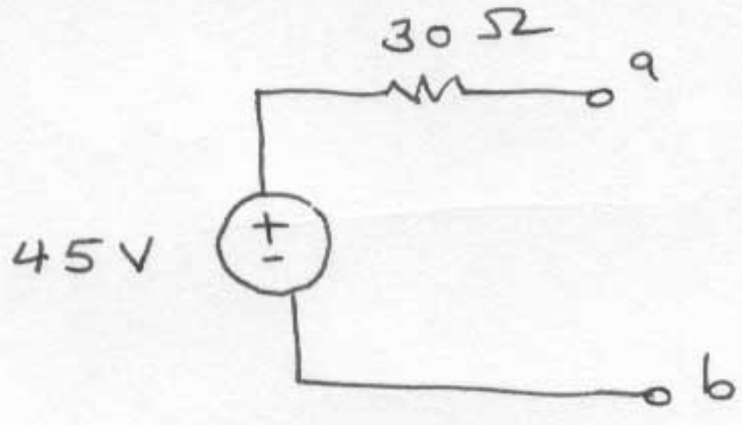
$\therefore \quad V_{oc} = V_{TH} = 45V$

Short Circuit

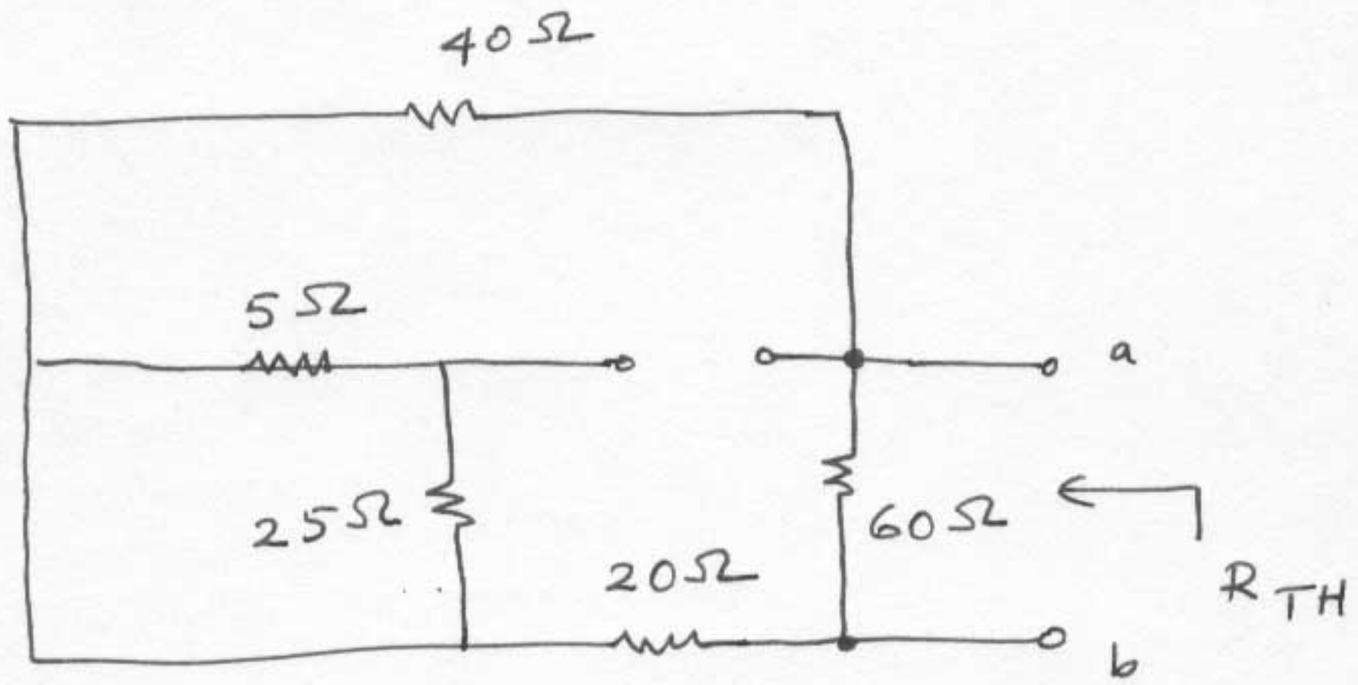
$$\therefore \frac{V_2 - 30}{40} - 1.5 + \frac{V_2}{20} = 0 \quad , \therefore V_2 = 30\ V \ , \ i_{sc} = \frac{V_2}{20} = 1.5\ A$$

$$R_{TH} = \frac{V_{oc}}{i_{sc}} = \frac{45}{1.5} = 30\,\Omega$$

The Thevenin equivalent circuit is:

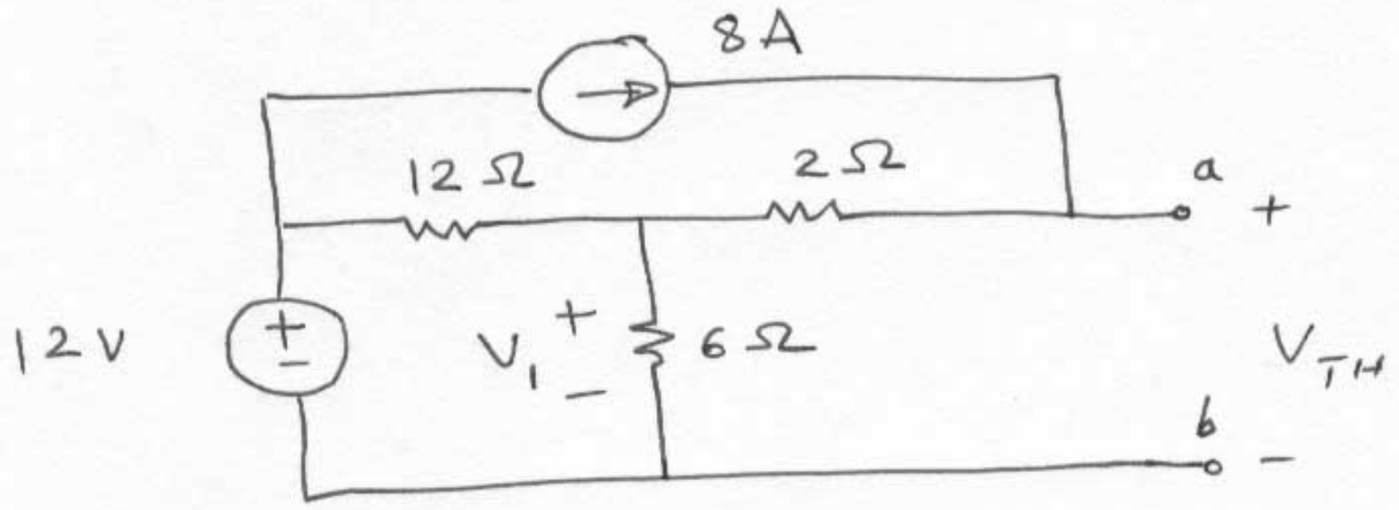


b) Find R_{TH} directly, set all independent sources to zero:



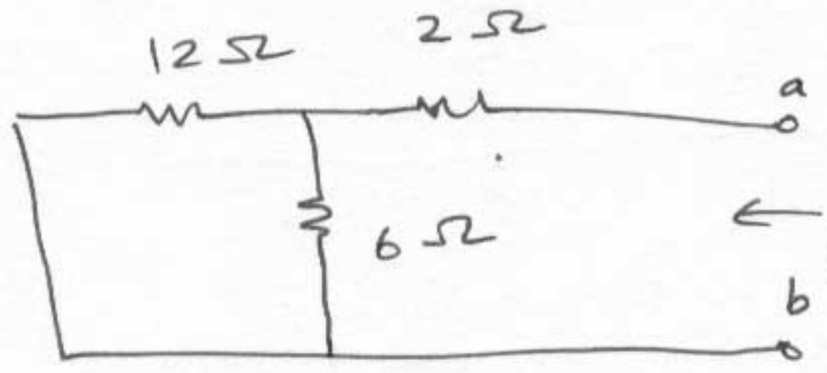
$$R_{TH} = (20+40) \,//\, 60 = 30\,\Omega \text{ (checks).}$$

P4.59

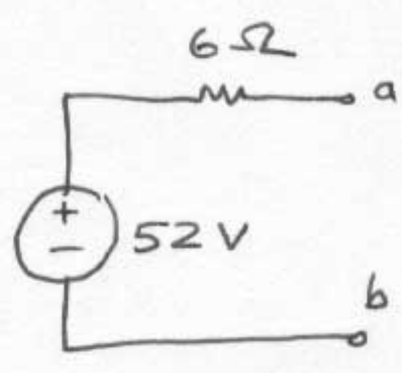


$$\frac{V_1 - 12}{12} + \frac{V_1}{6} - 8 = 0$$

$$\therefore \quad V_1 = 36\,V, \qquad V_{TH} = V_1 + 8(2) = 52\,V$$

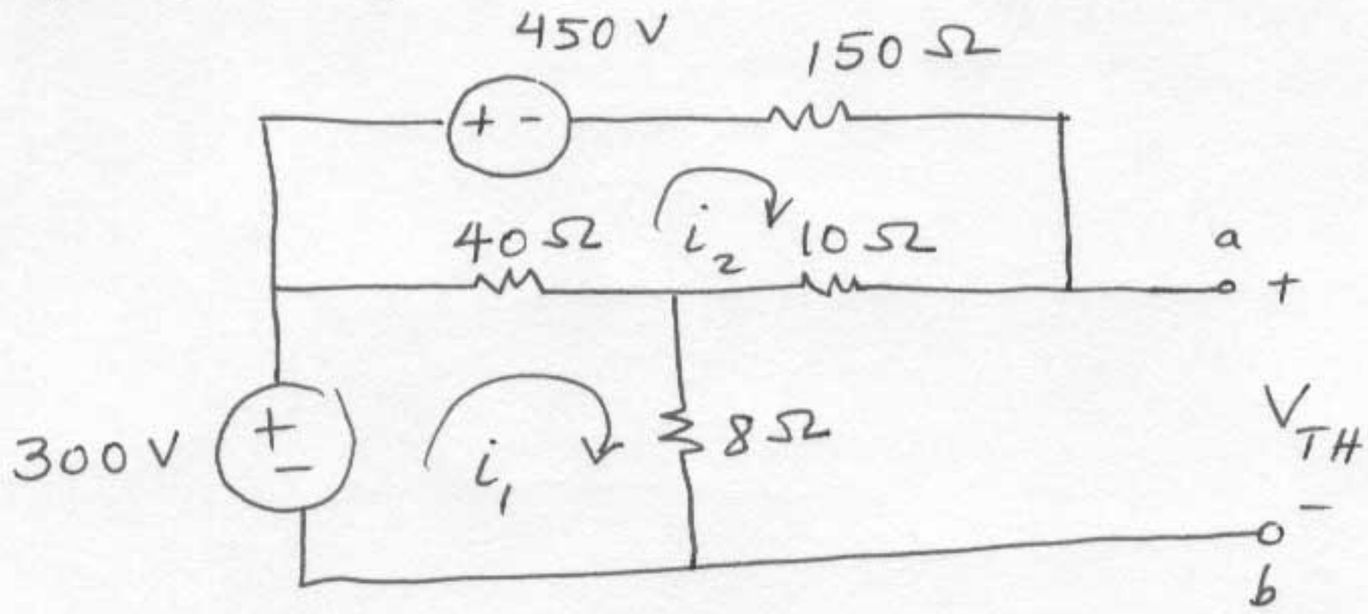


$$R_{TH} = 2 + 12\,//\,6 = 2 + \frac{12(6)}{12+6} = 6\,\Omega$$



P4.61

After using source transformation, we have:

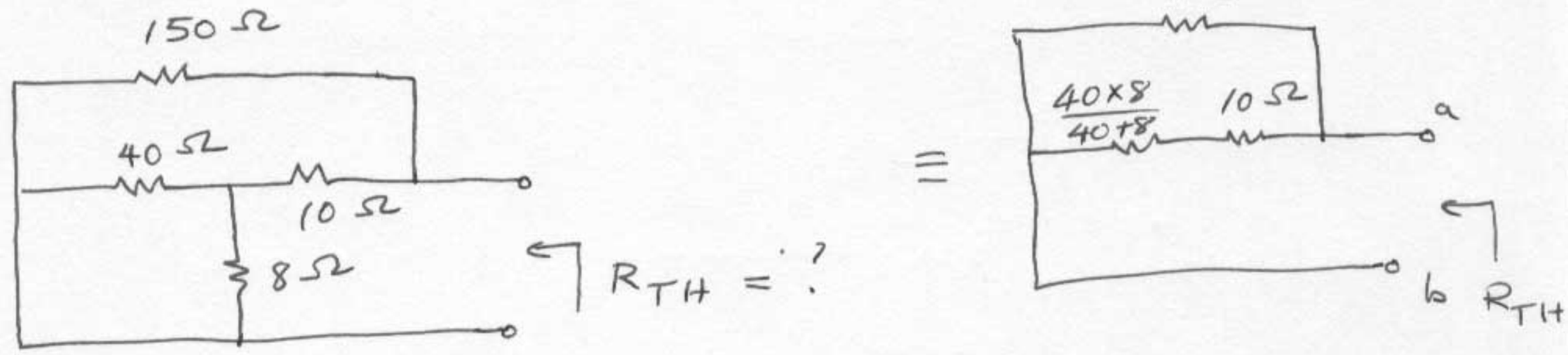


$$300 = 48 i_1 - 40 i_2$$

$$-450 = -40 i_1 + 200 i_2$$

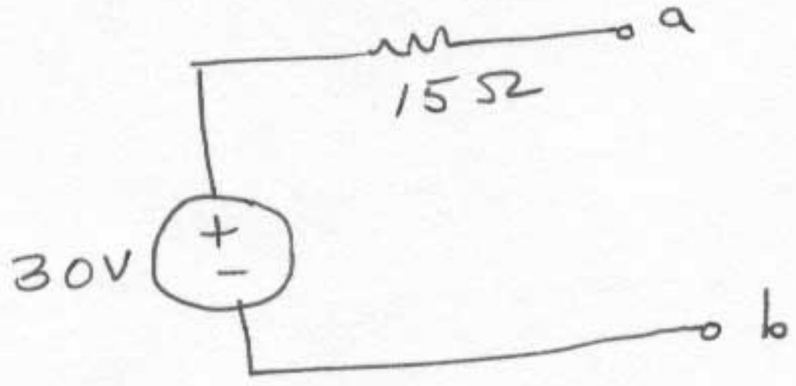
$$\therefore \quad i_1 = 5.25A \;, \quad i_2 = -1.2\,A$$

$$V_{TH} = 8 i_1 + 10 i_2 = 30\,V$$

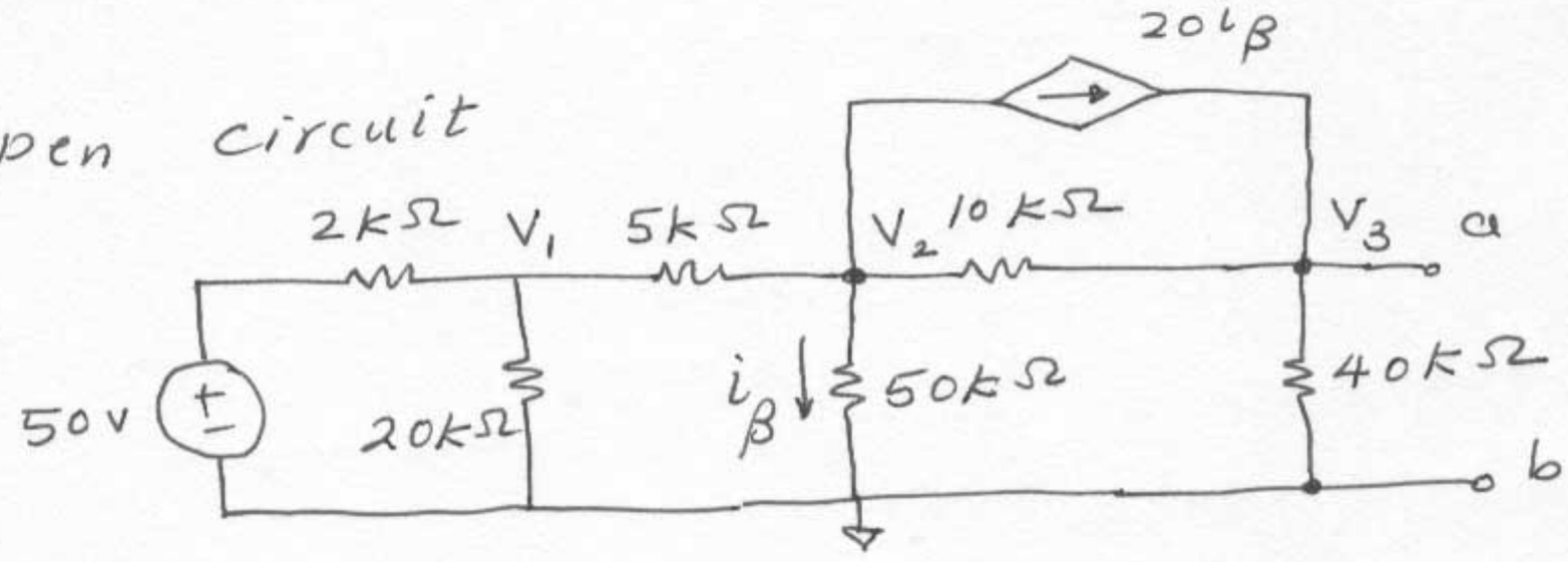


$$\therefore \quad R_{TH} = \left(\frac{40}{6} + 10\right) /\!/ 150 = \frac{\frac{100}{6} \times 150}{\frac{100}{6} + 150} = \frac{15000}{1000} = 15\,\Omega$$

Thevenin equivalent:



P4.66 Open circuit



$$\frac{V_1 - 50}{2} + \frac{V_1}{20} + \frac{V_1 - V_2}{5} = 0$$

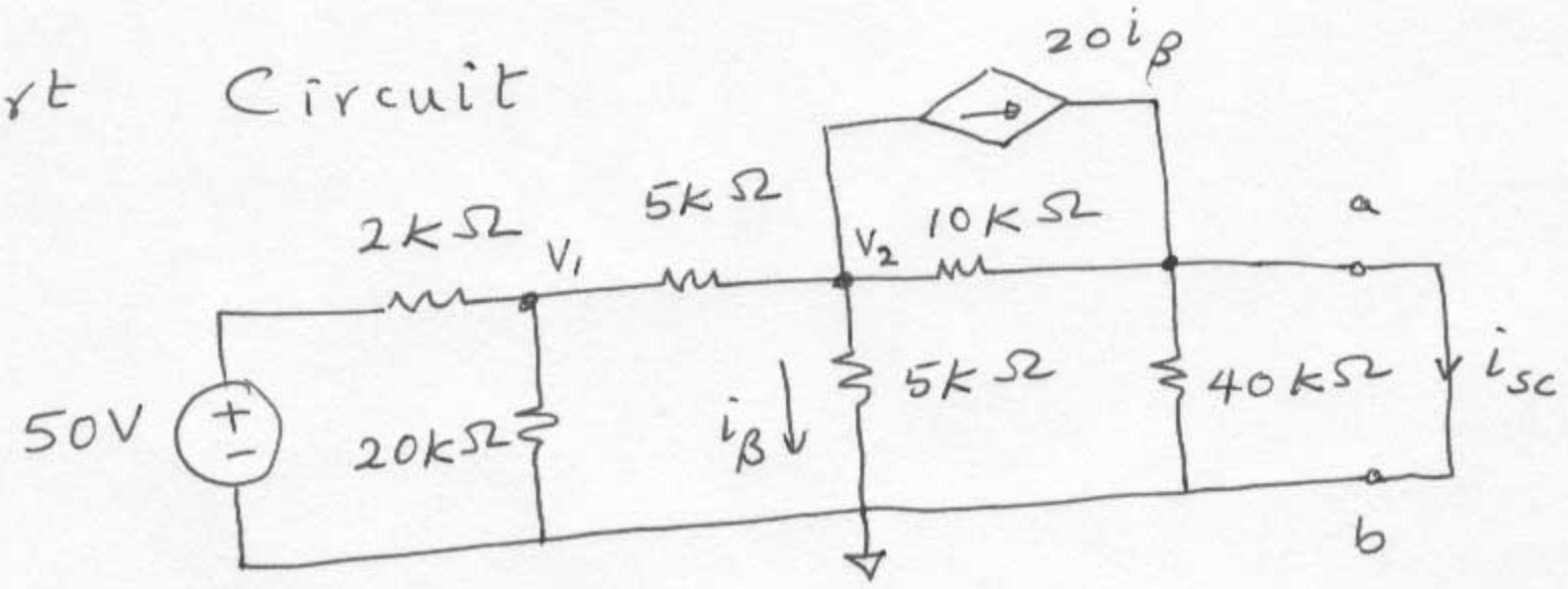
$$\frac{V_2 - V_1}{5} + \frac{V_2}{50} + \frac{V_2 - V_3}{10} + 20\left(\frac{V_2}{50}\right) = 0$$

$$\frac{V_3}{40} + \frac{V_3 - V_2}{10} - 20\left(\frac{V_2}{50}\right) = 0$$

} solving $\Rightarrow$

$$V_3 = V_{TH} = 100\ V$$

Short Circuit



$$\frac{V_1}{20} + \frac{V_1 - 50}{2} + \frac{V_1 - V_2}{5} = 0$$

$$\frac{V_2 - V_1}{5} + \frac{V_2}{50} + \frac{V_2}{10} + 20\left(\frac{V_2}{50}\right) = 0$$

} solving $\Rightarrow$

$$V_2 = 10\ V$$

$$\therefore i_{sc} = \frac{20(10)}{50} + \frac{10}{10} = 4 + 1 = 5\ mA$$

$$\therefore R_{TH} = \frac{V_{TH}}{i_{sc}} = \frac{100}{5mA} = 20\ \Omega \times 1000 = 20\ k\Omega$$