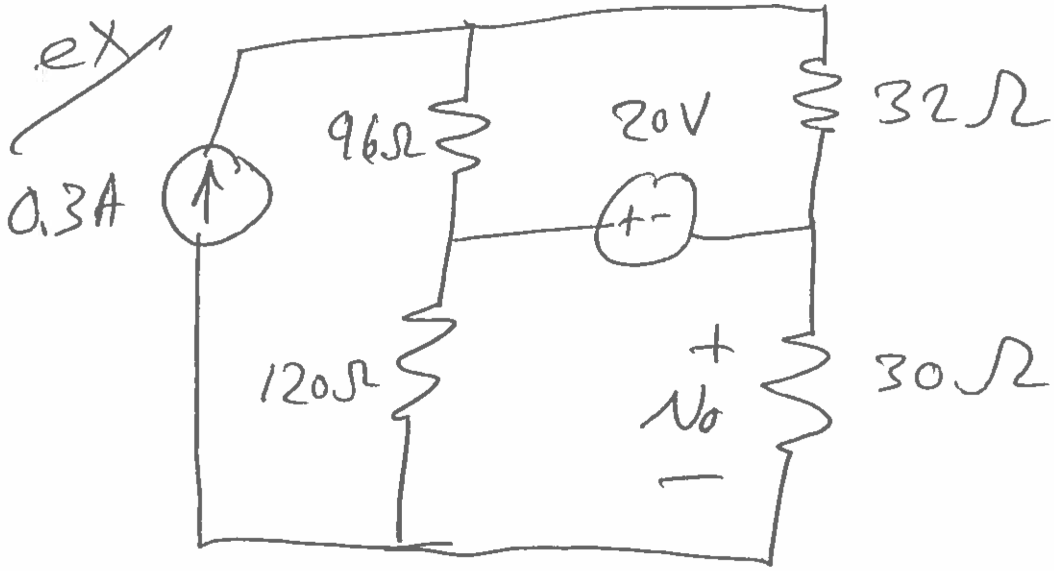
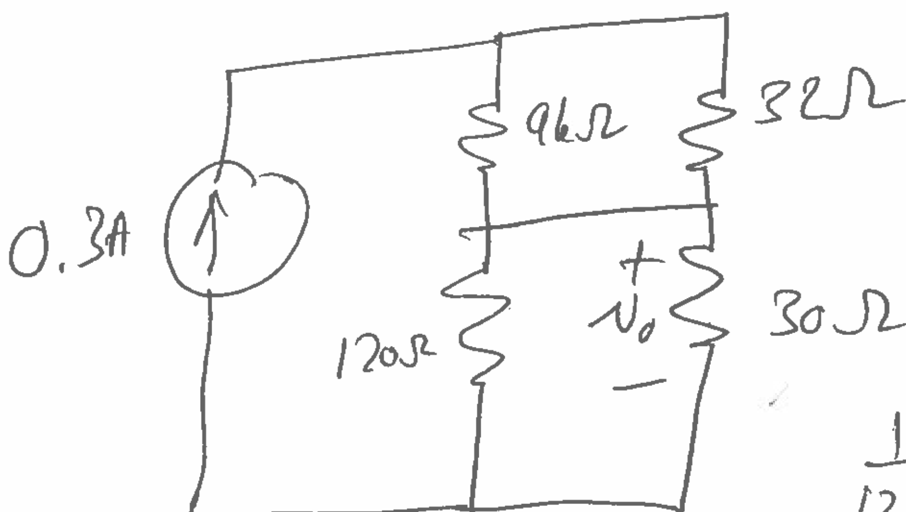
ex



$v_o = ?$

v_{oi} Deactivate 20 V



$$\frac{1}{96} + \frac{1}{32} = \frac{1+3}{96}$$

$$\frac{96}{4} \Rightarrow 24$$

$$\frac{1}{120\Omega} + \frac{1}{30} = \frac{1+4}{120}$$

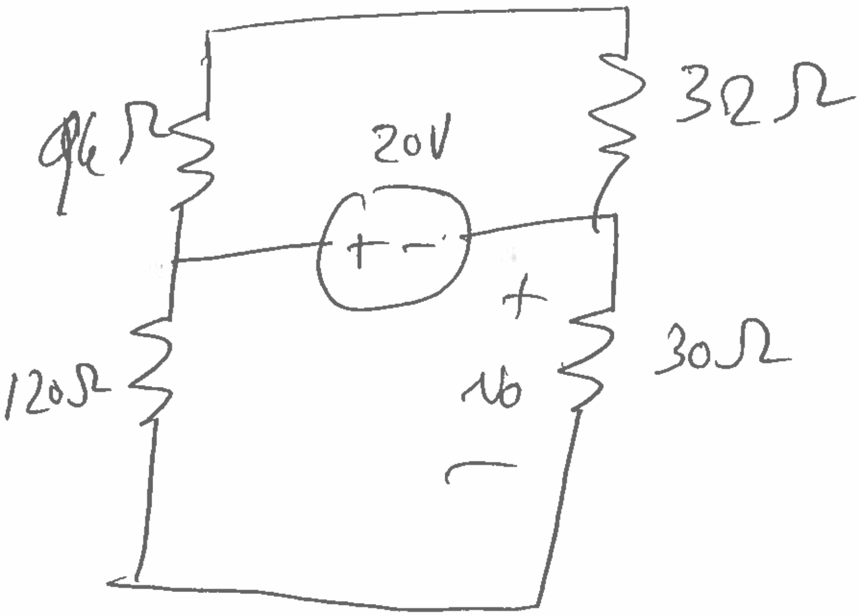
$$\frac{120}{5} = 24$$

$$i_{30\Omega} = \frac{(0.3A)\,\frac{1}{30}}{\frac{1}{24}} = \frac{24}{30}(.3A)$$

$$v_{oi} = \frac{24}{30}(.3A)(30\Omega) = 24(.3)\,V = 7.2V$$

$$\boxed{+7.2V}$$

Deactivate current supply



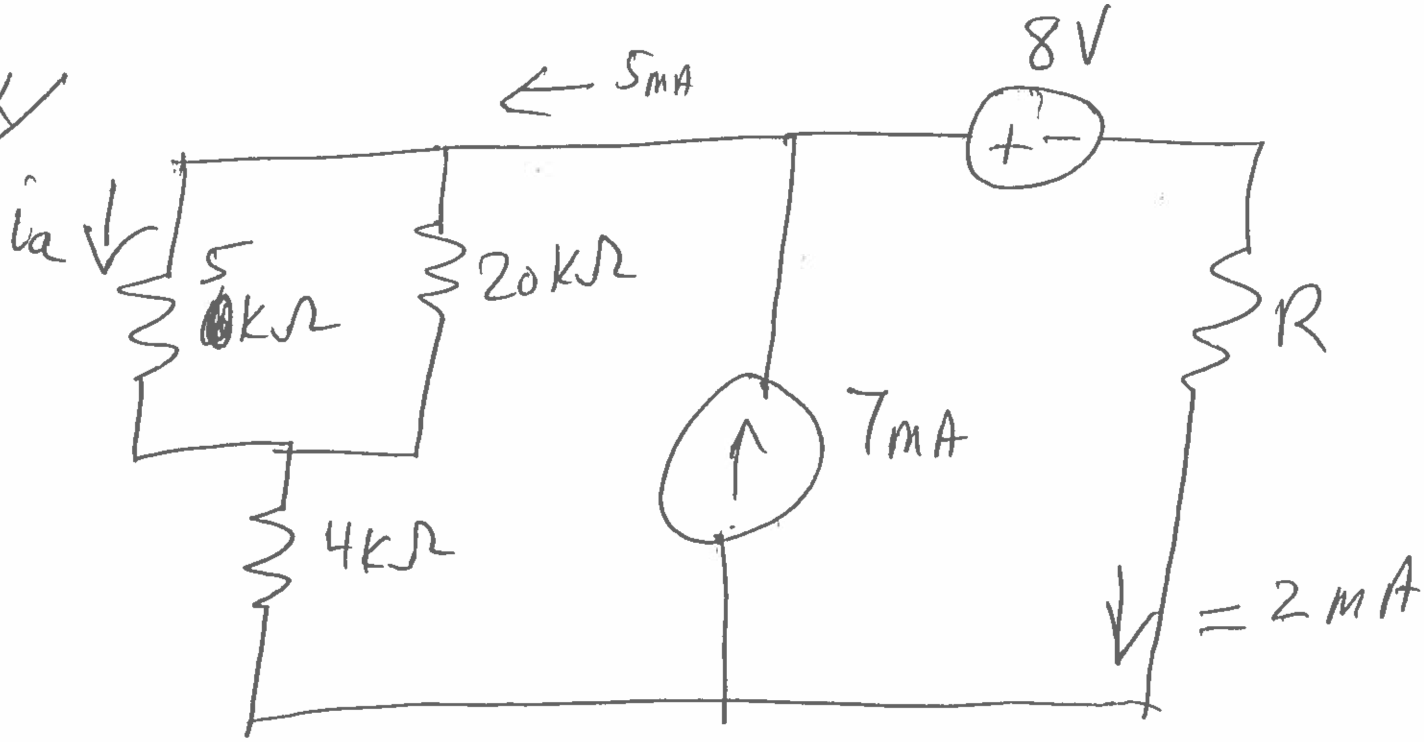
$$v_{30} = \frac{30\Omega}{150\Omega}(20V) = 4V$$

$$v_{30} = -4V$$

$$v_o = v_{30i} + v_{30V} = +7.2V + (-4V)$$

$$\boxed{v_o = +3.2V}$$

ex



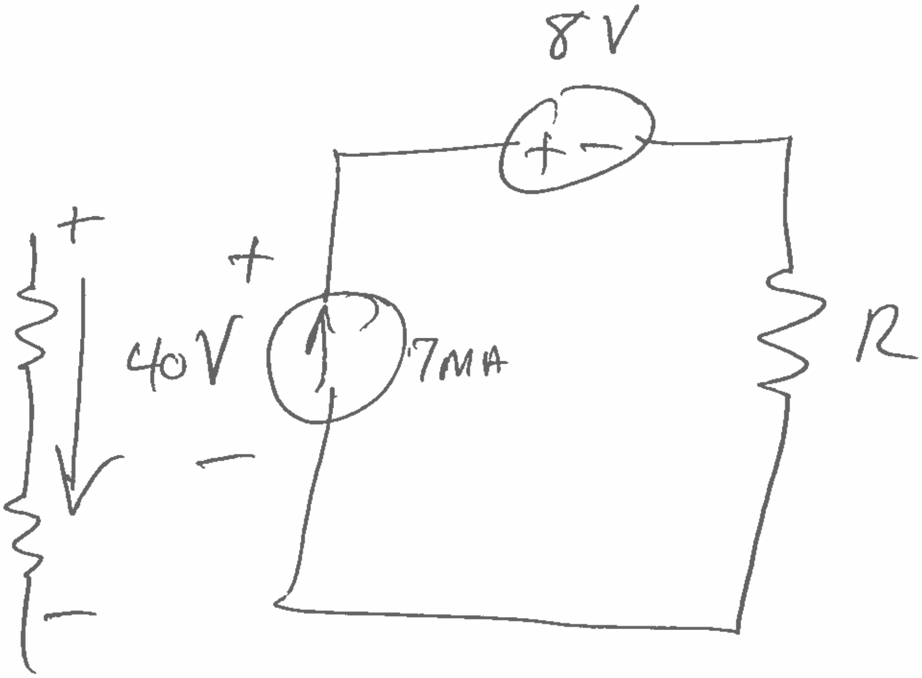
$i_a = ?$ $R = ?$

$$i_a = \frac{5mA\left(\frac{1}{5k\Omega}\right)}{\frac{1}{5k\Omega} + \frac{1}{20k\Omega}} = \frac{5mA\left(\frac{1}{5k\Omega}\right)}{\frac{4+1}{20k\Omega}}$$

$$i_a = 1mA\left(\frac{1}{1k\Omega}\right)\frac{20k\Omega}{5} = \boxed{4\,mA = i_a}$$

$5k\Omega \parallel 20k\Omega \Rightarrow 4k\Omega$

$$V_{7mA} = 5mA\,(8k\Omega) = 40V$$

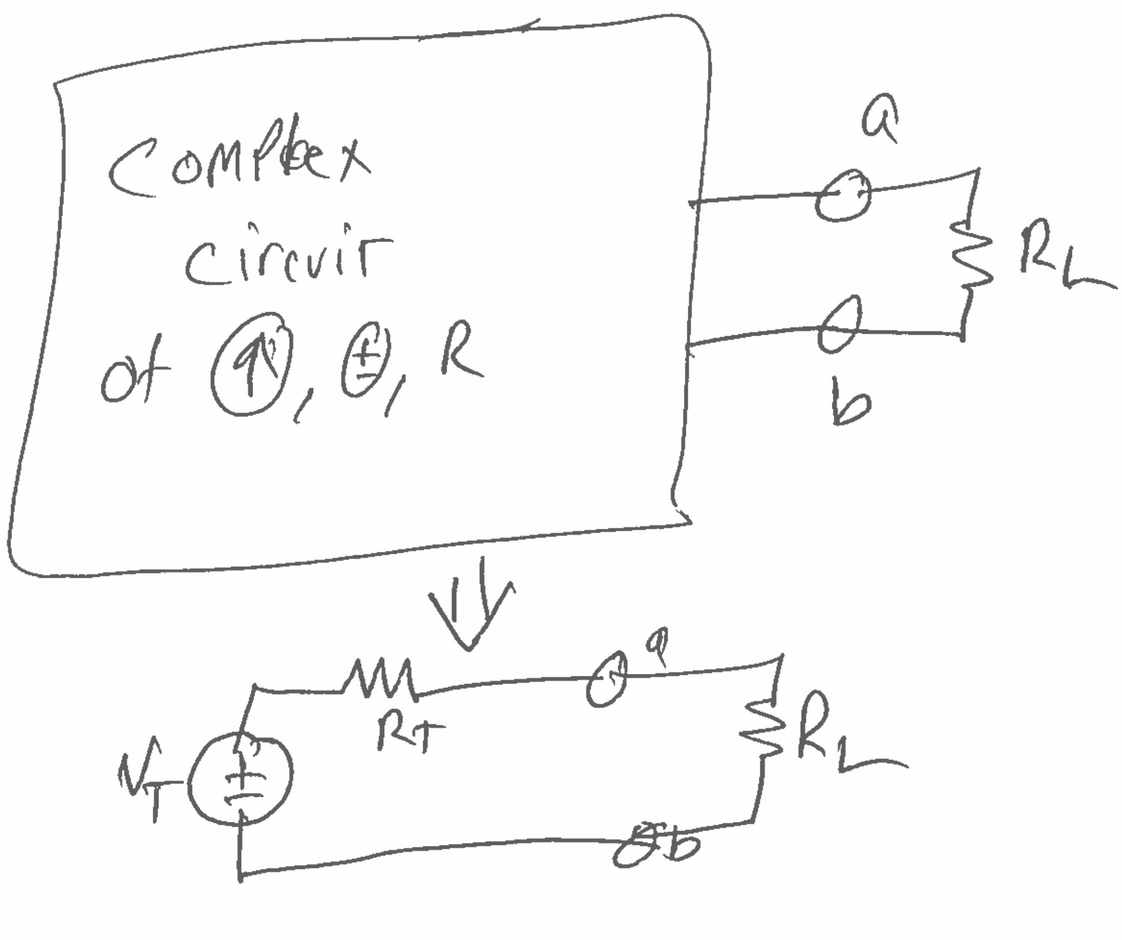


$$40V - 8V = V_R = 32V$$

$$R = \frac{V_R}{i_R} = \frac{32\,V}{2\,mA} = 16K\Omega$$

$$\boxed{R = 16K\Omega}$$

Thevenin's Theorem requires for any circuit of resistive elements and energy sources with an identified terminal pair, the circuit can be replaced by a series combination of a voltage source, V_T, and a resistance R_T where V_T is the open circuit voltage at the terminals and R_T is the ratio of the open circuit voltage to the short circuit current at the terminal.



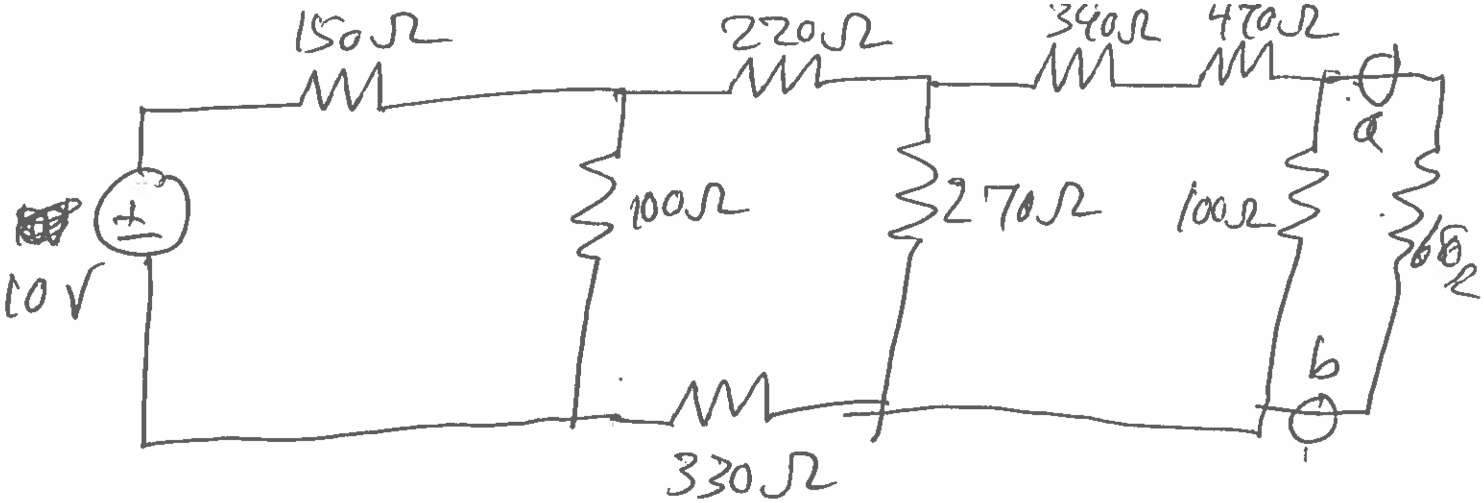
How To find Thevenin equivalent

1) Deactivate Power Sources find R_T by Circuit reduction

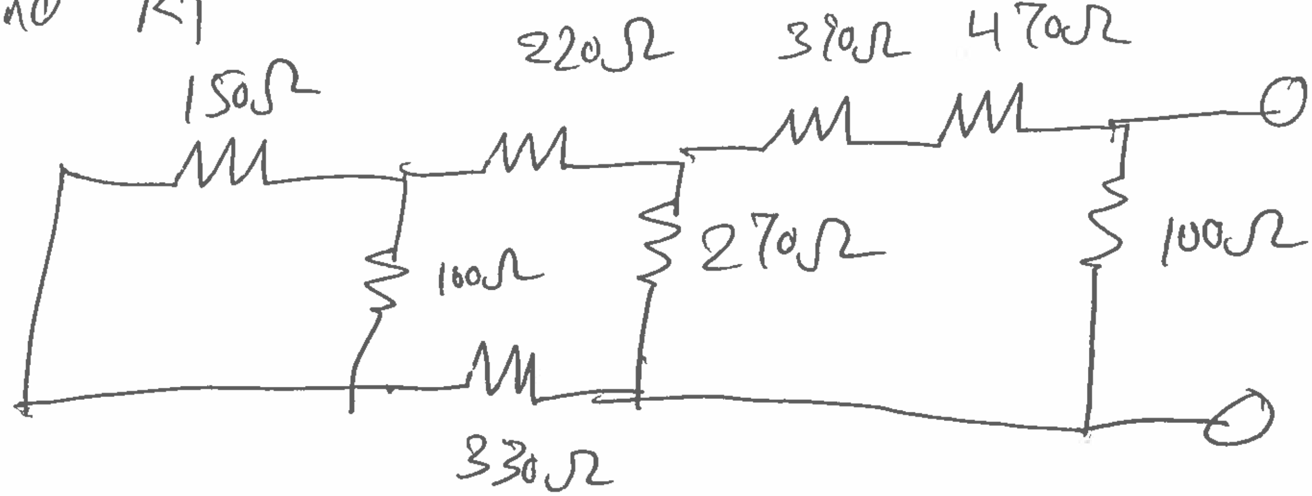
2) Deactivate Voltage Sources by replacing with Short-circuits

3) Deactivate current sources by replacing with Open-circuits

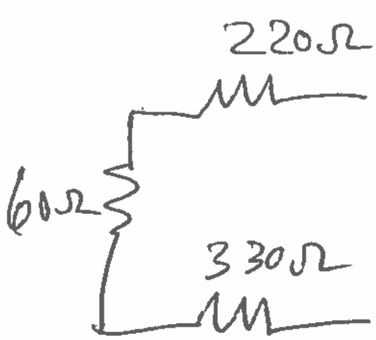
4) Find V_{oc} with Sources Active.



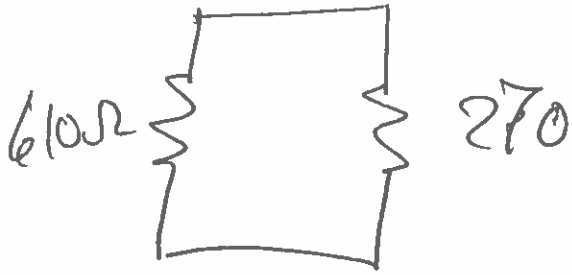
Find R_T



$$\frac{1}{150} + \frac{1}{100} = \frac{2+3}{300\Omega} = \frac{1}{60\Omega}$$



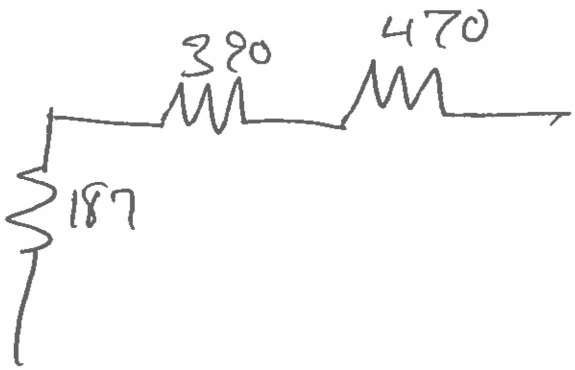
$\Rightarrow 610\Omega$



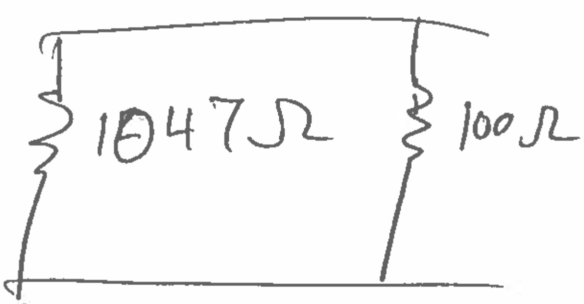
$$\frac{1}{610\Omega} + \frac{1}{270\Omega} \Rightarrow 187\Omega$$

$$0{,}0016 + 0{,}0037 = 0{,}0053$$

$$\frac{1}{0{,}0053} = 187{,}16\Omega$$

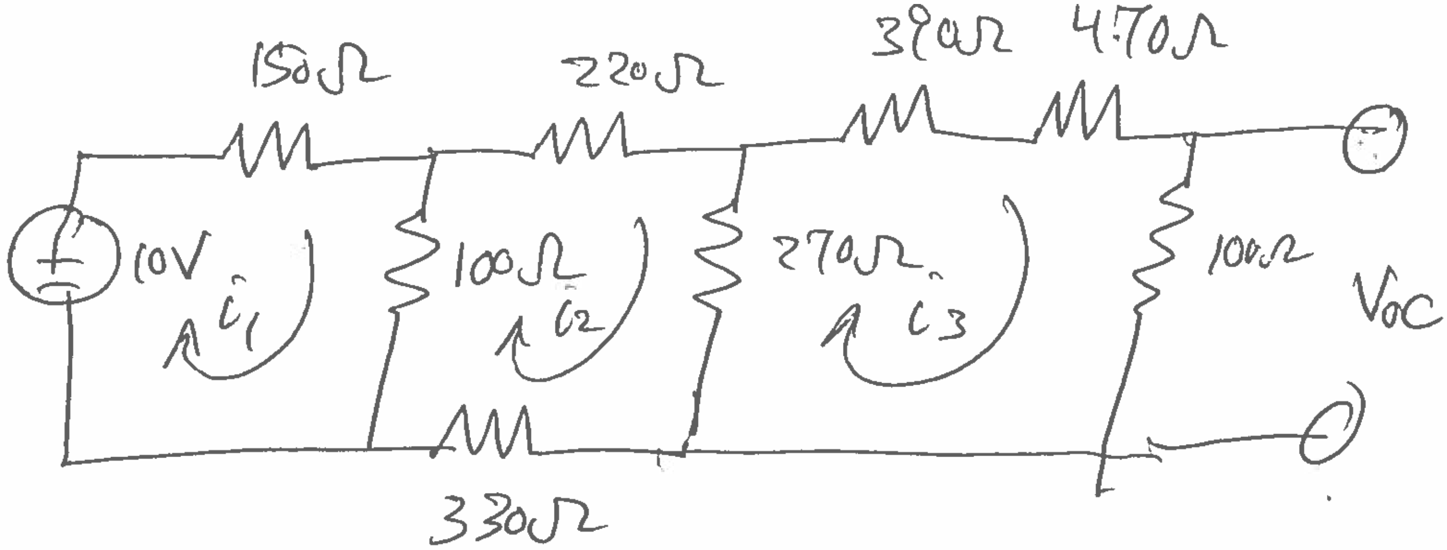


$$\Rightarrow 1047\Omega$$



$$\frac{1}{1047\Omega} + \frac{1}{100\Omega}$$

$$\Rightarrow 91{,}3\Omega \quad R_T$$



$$V_{oc} = 100\Omega\, i_3$$

$$10\,V = i_1\,(150\Omega + 100\Omega) - i_2\,(100\Omega)$$

$$0 = -i_1\,(100\Omega) + i_2\,(100\Omega + 220\Omega + 270\Omega + 330\Omega) - i_3\,(270\Omega)$$

$$0 = -i_2\,(270\Omega) + i_3\,(270\Omega + 390\Omega + 470\Omega + 100\Omega)$$

Use MATLAB

$i_1 = 41.9495\,mA$

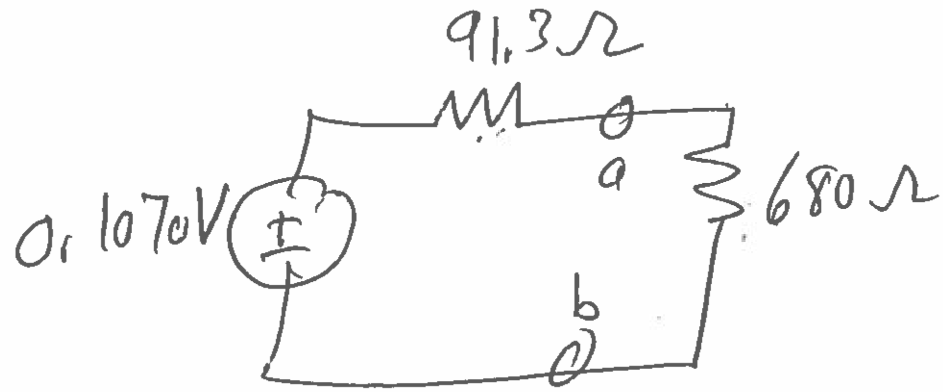
$i_2 = 4.9737\,mA$

$i_3 = 1.0698\,mA$

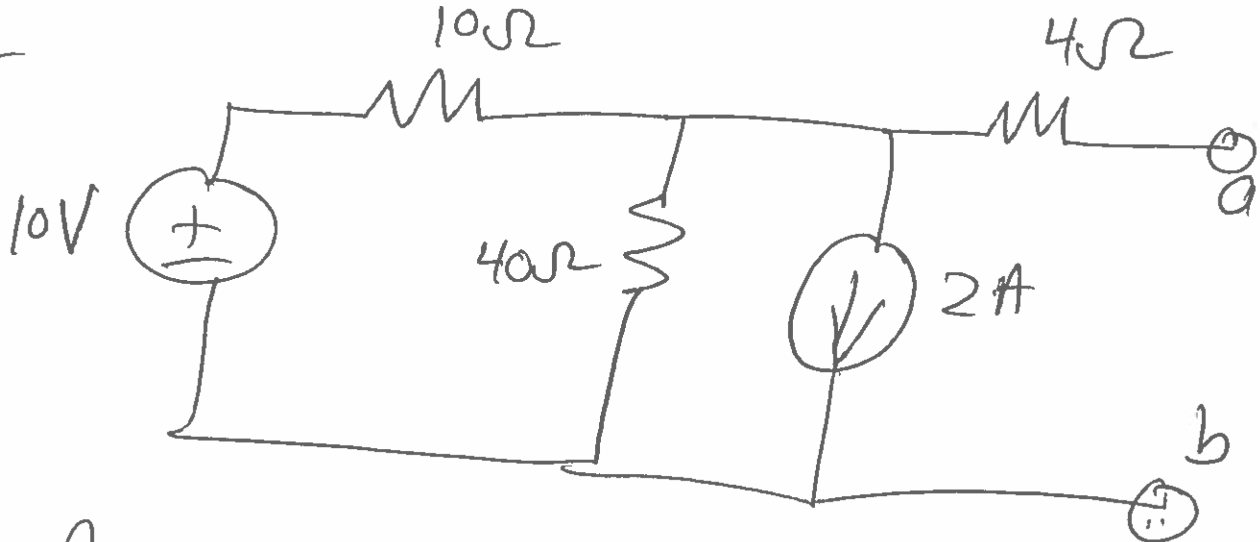
$$V_{oc} = 100\Omega\, i_3 = 100\Omega\,(1.0698\text{ mA})$$

$$V_{oc} = 0.1070\text{V}$$

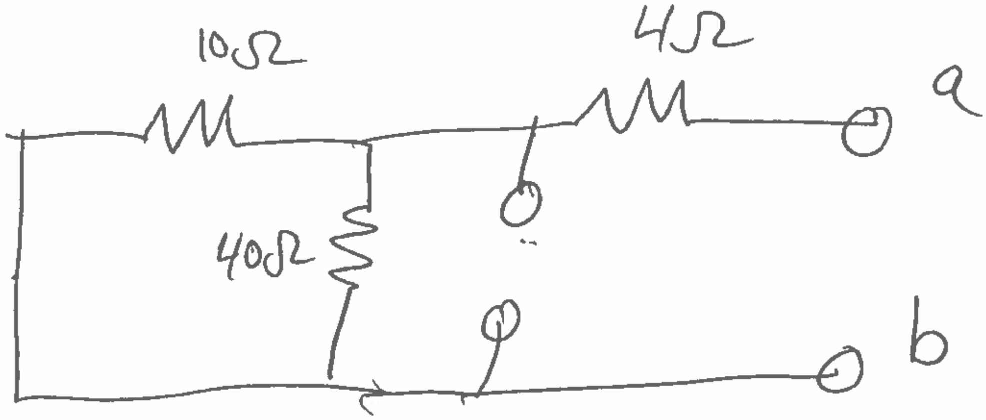
Thevenin circuit is



ex



Find R_T



$$\frac{1}{10\Omega} + \frac{1}{40\Omega} = \frac{4+1}{40\Omega} = \frac{5}{40\Omega} = \frac{1}{8\Omega}$$

$$R_T = 8\Omega + 4\Omega = \boxed{12\Omega = R_T}$$