Attribution Nidhal Abdulaziz

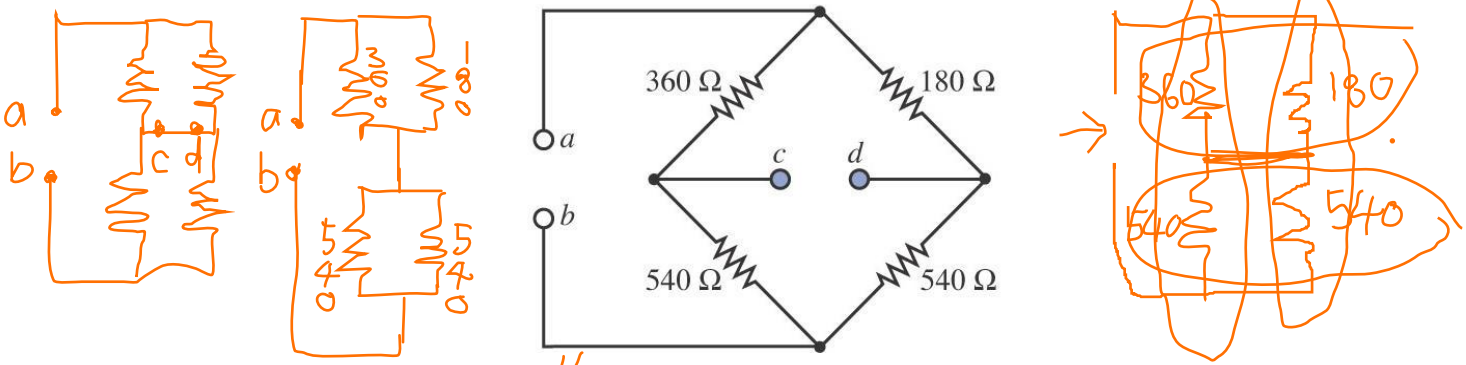
ENGG104 Tutorial 11 Class Questions [past exam questions]

Team Name: _____

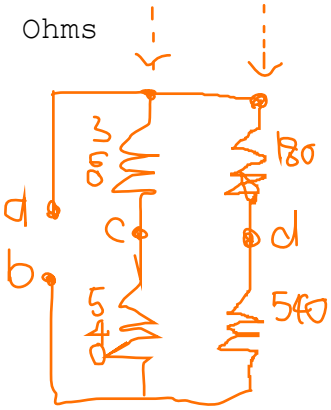
QUESTION 1 -

Determine the equivalent resistance, R_{eq}, looking in at terminals marked *a* and *b* when:

(a) terminals *c* and *d* are open circuited, and
(b) terminals *c* and *d* are short circuited.

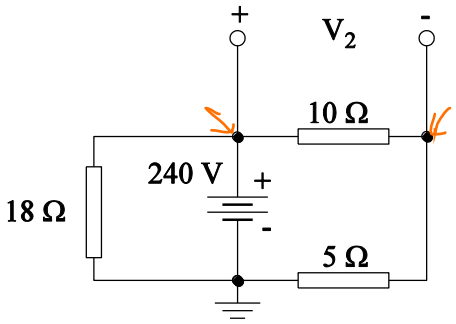


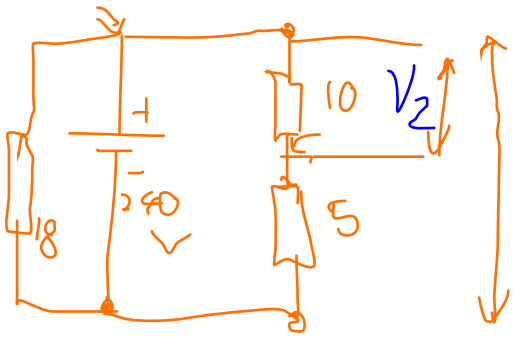
a) 360+ 540 in parallel with 180 + 540 => 400 Ohms
b) 360//180 + 540//540 => 390 Ohms



QUESTION 2 -

Using the voltage divider rule, determine the voltage V_2.



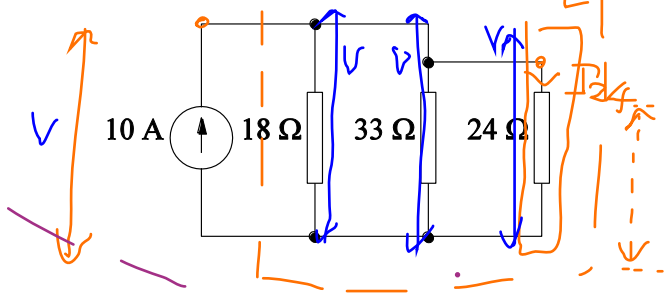


V2 = 240x10/15 => 160V

$\frac{10}{15} \times 240$

QUESTION 3 -

(a) Determine the current in the 24 Ω resistor.
(b) What is the voltage across the current source?

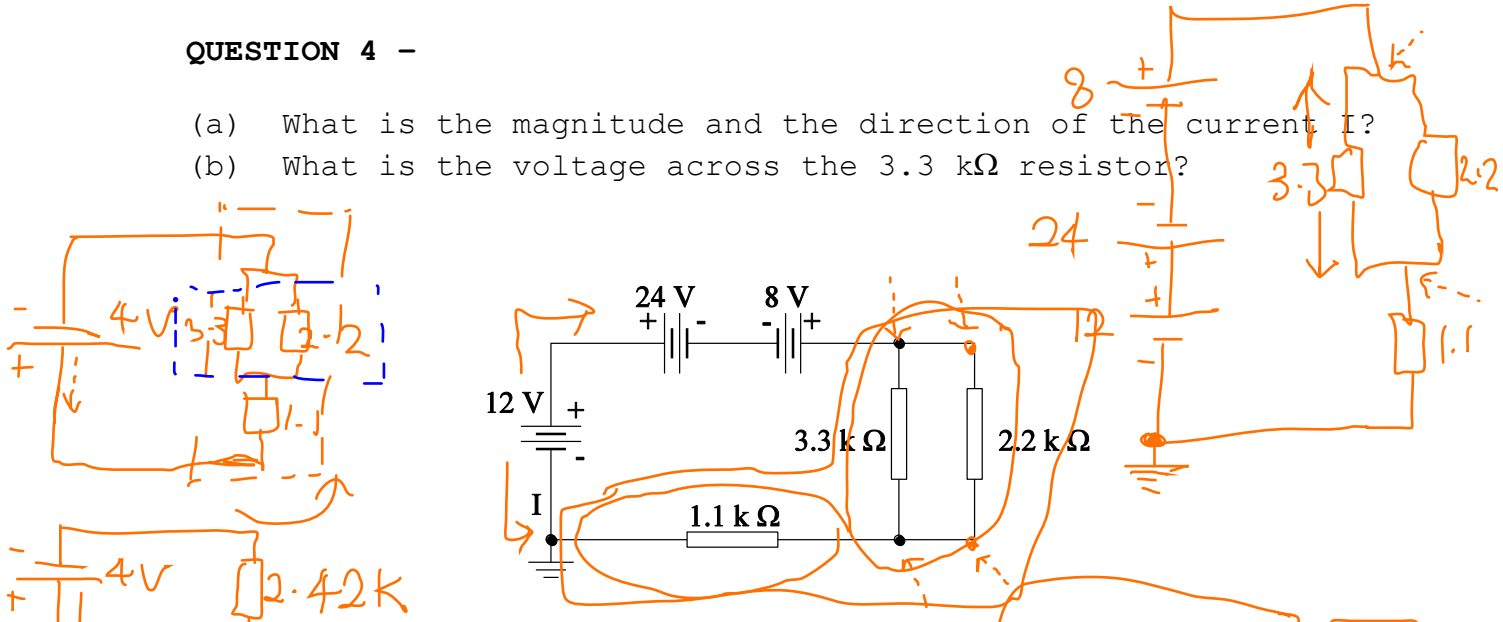


(a) Determine Total R first. Then use general form of current divider.
R_T = 7.84 Ohms I_{24} = 10x7.84/24 =>3.27Amps
(b) V = 24 x 3.27 =>78.42 V

QUESTION 4 –

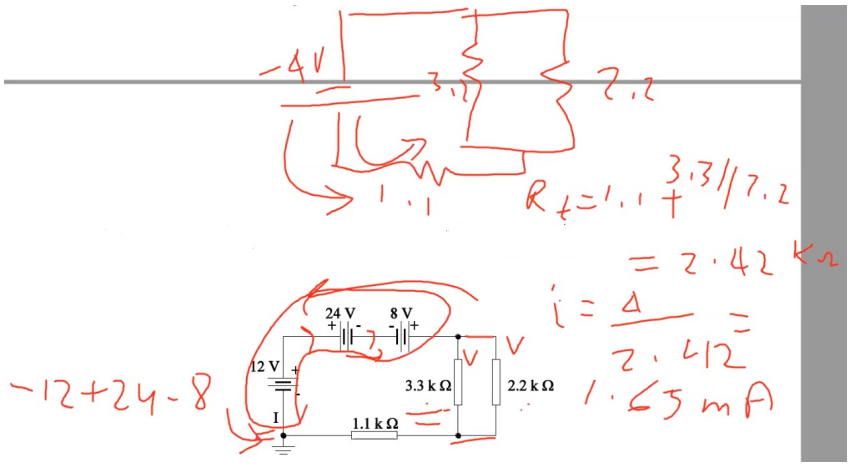
(a) What is the magnitude and the direction of the current I?

(b) What is the voltage across the 3.3 kΩ resistor?



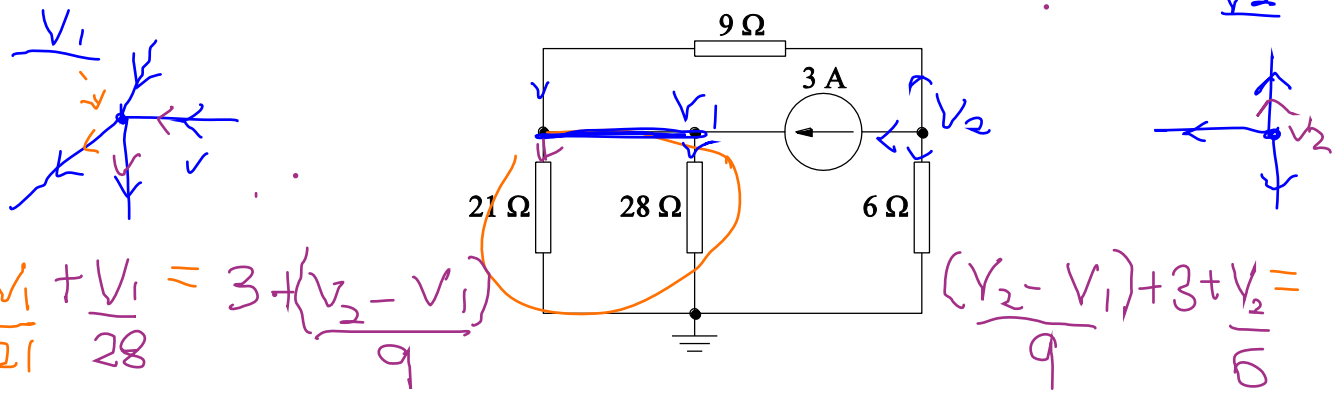
(a) First group all the voltage sources. =>12 -24 +8 => -4V (same polarity as the 24V source). Determine Total R. R = 1.1K + 3.3//2.2 =>2.42k Hence current is 4/2.42K=> 1.65 mA flowing anti clock wise in the circuit.

(b) V = 4x1.32/2.42 => 2.18V (the 1.32K being the total resistance of the 3.3 and 2.2K resistors)



QUESTION 5

Using Nodal Analysis techniques, write the equations for the node voltages using the system ground as the reference node. Indicate the node voltages on the diagram. Solve for the nodal voltages



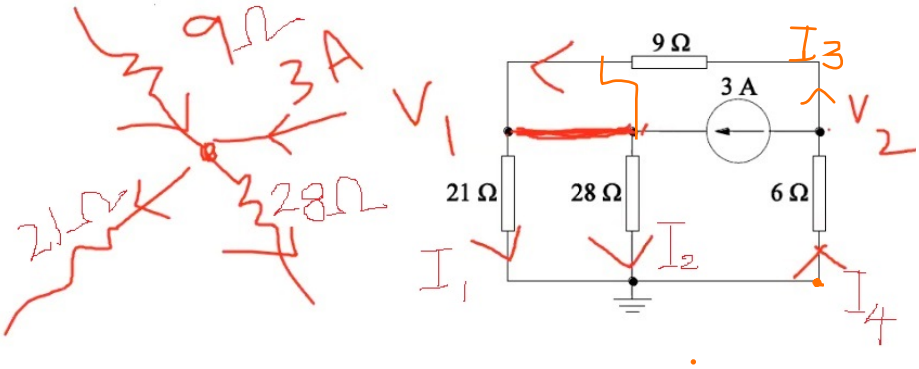
$\frac{V_1}{21} + \frac{V_1}{28} = 3 + \frac{(V_2 - V_1)}{9}$ $\qquad \frac{(V_2 - V_1)}{9} + 3 + \frac{V_2}{6} = 0$

Combine 21 and 28 ohm resistors into one (they share a single node)=> 12 Ohm resistor

$-(1/12+1/9)V_1 + (1/9)V_2 = -3$
$(1/9)V_1 - (1/6+1/9)V_2 = 3$

Solve for V_1 and V_2

KCL Node (1)
$3A + I_3 = I_1 + I_2 \Rightarrow$ $\quad 3 + \frac{V_2 - V_1}{9} = \frac{V_1 - 0}{21} + \frac{V_1 - 0}{28}$



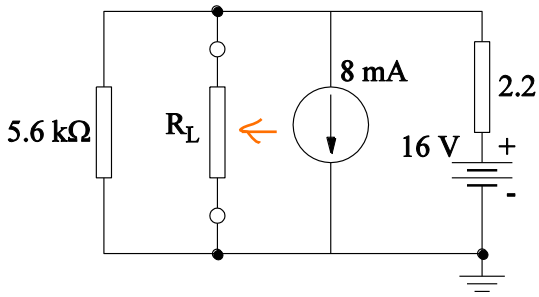
KCL V_2
$I_4 = 3 + I_3$
$\frac{0 - V_2}{6} = 3 + \frac{V_2 - V_1}{9}$

QUESTION 6

Find the

(a) Thévenin equivalent circuits for the network external to the resistor R_L.

How to find RTh



What is the value of RTh

How to find VTh

There are 2 sources, either use super position or convert current to voltage source (with 5.6K resistor) and solve

For R_{Th}, open current source and short out voltage source..

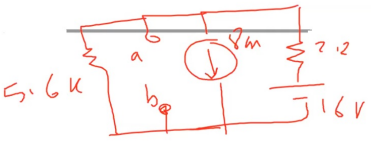
R_{Th} = 5.6//2.2 => 1.58 K Ohms

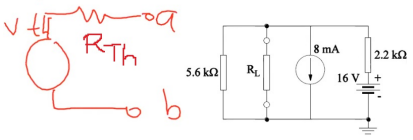
Voltage due to 8mA source is -12.64V

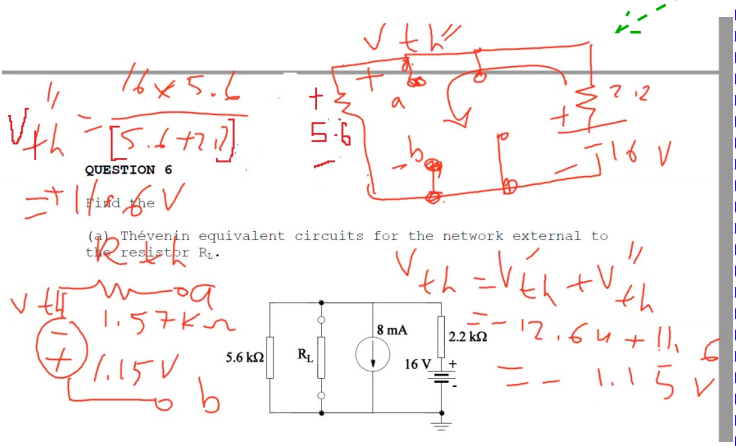
Voltage due to 16V source is 11.49 V

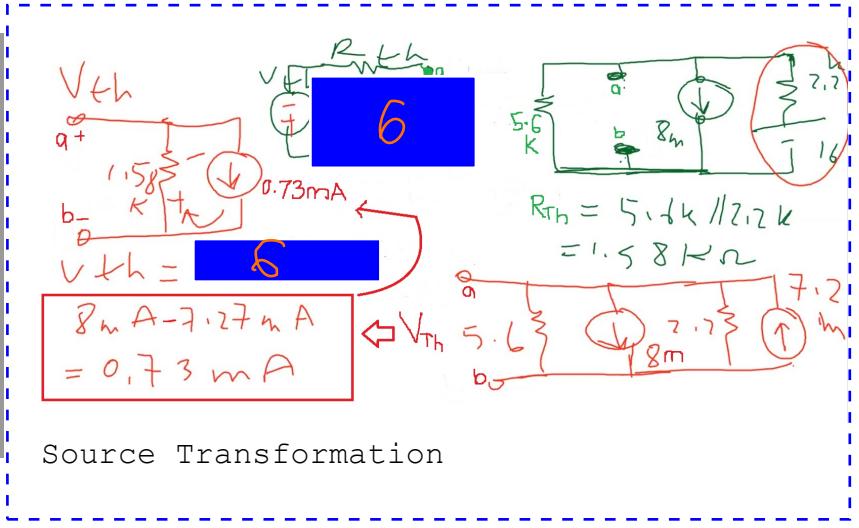
Eth = -12.64 + 11.49 = -1.15 V

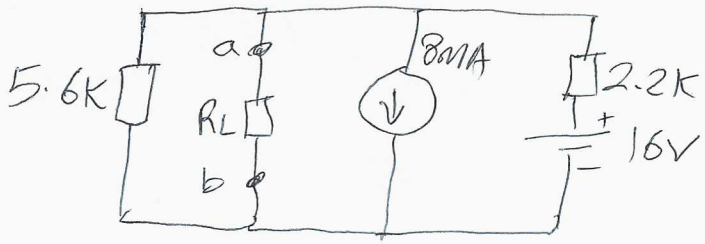
Superposition theorem



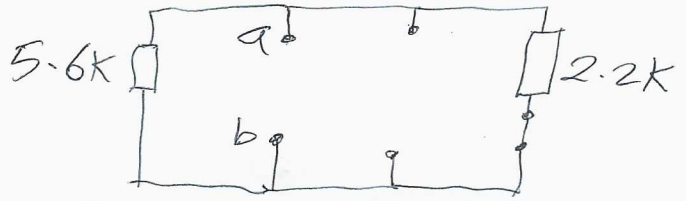




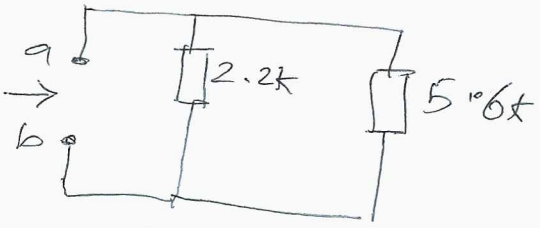




Find R_{TH}



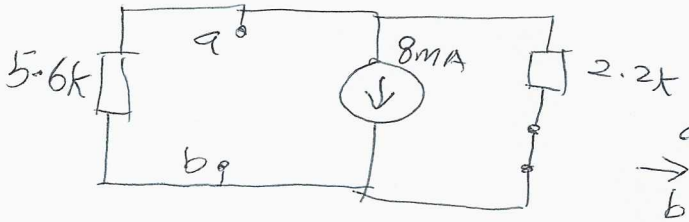
$\Rightarrow$

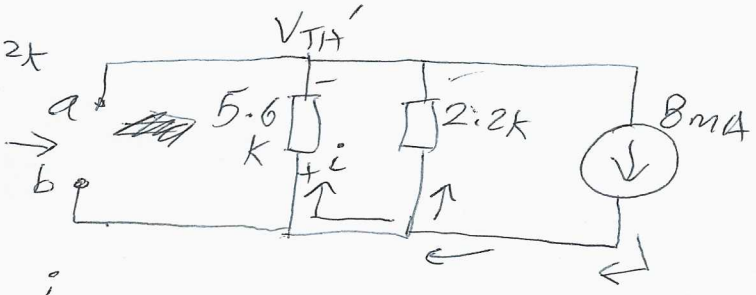


$$R_{TH} = \frac{(2.2k)(5.6k)}{(2.2k)+(5.6k)}$$

$$R_{TH} = 1.58k\Omega$$

Superposition theorem





(current divider)

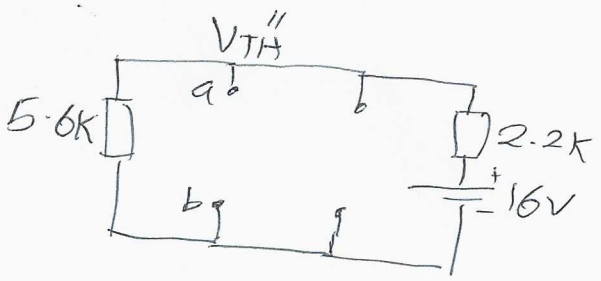
$$i_{5.6k} = 8mA \times \frac{2.2k}{5.6k + 2.2k}$$

$$= 2.256\ mA$$

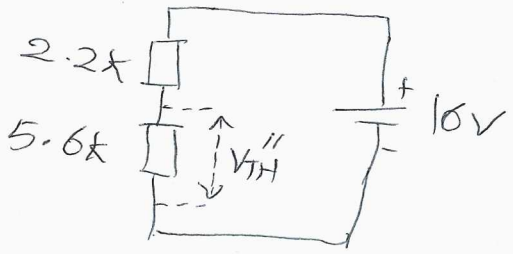
$$V_{TH}' = -i(5.6k)$$

$$= -(2.256\ mA)(5.6k\Omega)$$

$$= -12.63V$$



$\Rightarrow$



(Voltage divider)

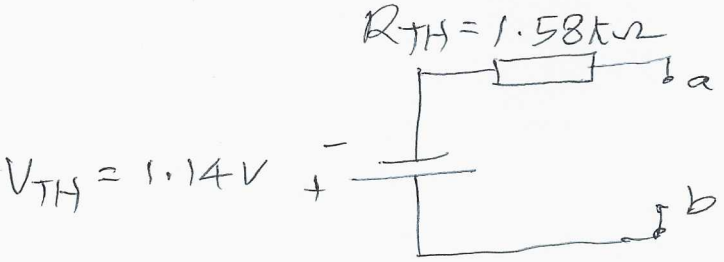
$$V_{TH}'' = \frac{5.6k}{5.6k + 2.2k} \times 16V$$

$$V_{TH}'' = 11.49V$$

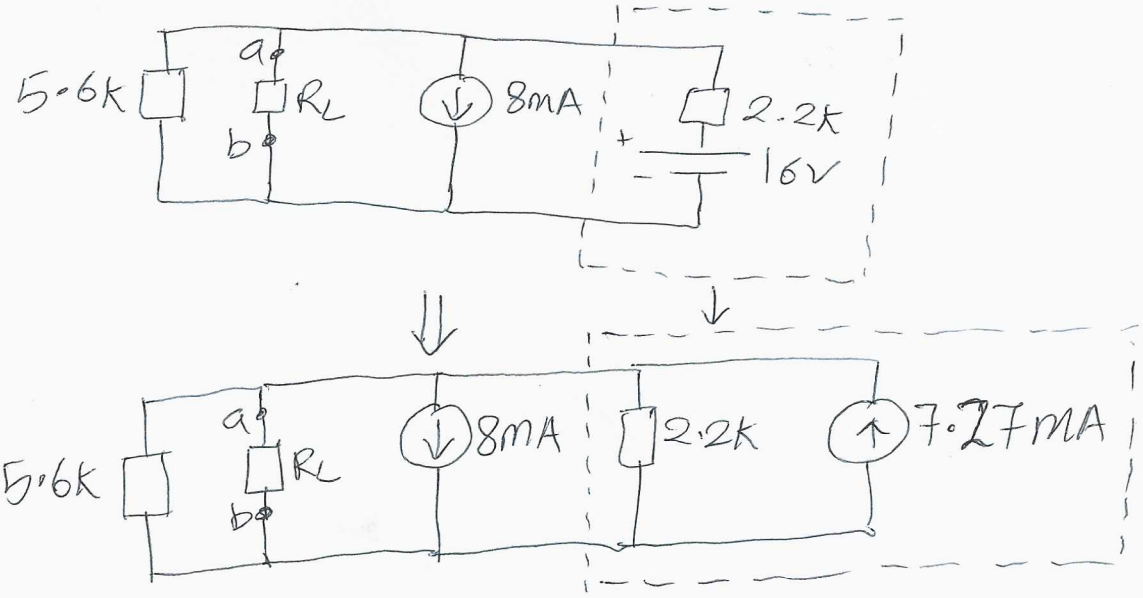
$$V_{TH} = V_{TH}' + V_{TH}''$$

$$V_{TH} = -12.63 + 11.49 = -1.14V$$ ✓

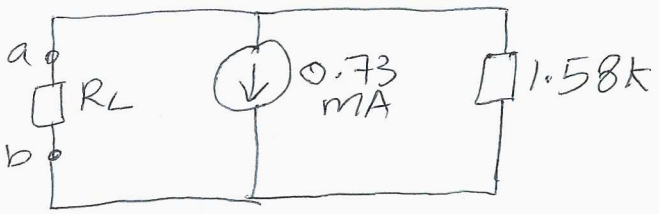
~~Using source conversion~~



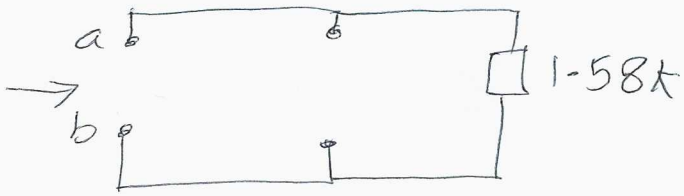
Using source conversion



$$R_T = \frac{(5.6k)(2.2k)}{(5.6k)+(2.2k)} = 1.58k\Omega$$

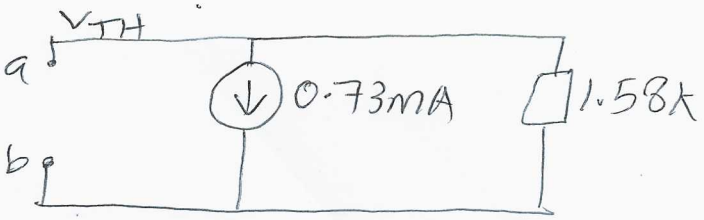


Find R_{TH}



$$R_{TH} = 1.58k\Omega$$

Find V_{TH}



$$V_{TH} = -(0.73mA)(1.58k\Omega)$$
$$= -1.15V$$