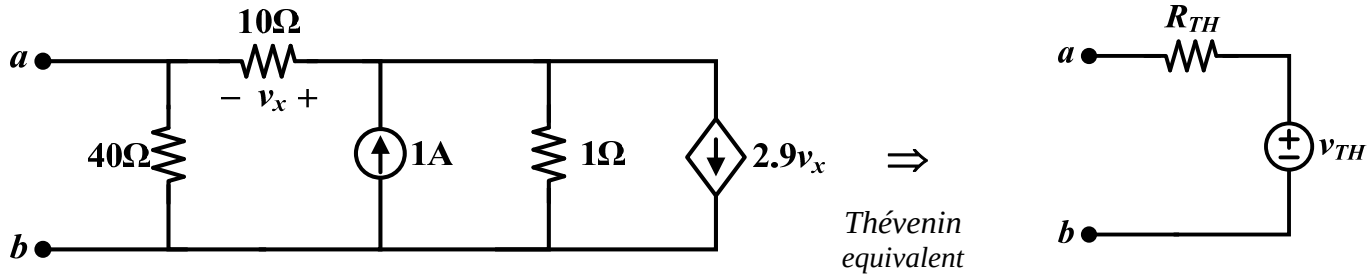
電路學(EE2210)第五次隨堂考

2015年4月22日
時間：10 分鐘
Close Book

學號：_____

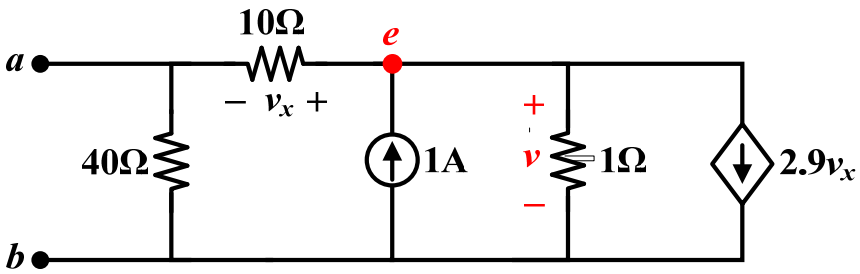
姓名：_____

Find the Thévenin equivalent paramaters, v_{TH} and R_{TH}, for the port *ab* of the network shown in the following figure.



Solutions:

(1) Thévenin equivalent voltage v_{TH}



The open circuit voltage at port ab is the Thévenin equivalent voltage v_{TH}.

To find the Thévenin equivalent voltage $v_{TH,}$ Let us first apply KCL at node *e*:

$$1-\frac{v_x}{10}-\frac{v}{1}-2.9v_x=0$$

$$\Rightarrow 10v+30v_x=10 \quad ...(i)$$

Then, apply KCL at node *a*:

$$-\frac{v-v_x}{40}+\frac{v_x}{10}=0$$

$$\Rightarrow v=5v_x \quad ...(ii)$$

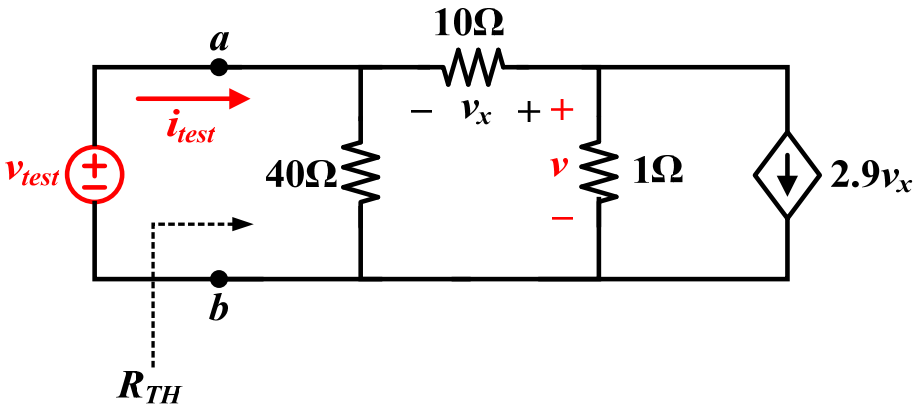
By solving (i) and (ii) simutaneously, v and v_x can be found.

$$\Rightarrow v_x=\frac{1}{8}\text{V} \text{ and } v=\frac{5}{8}\text{V}$$

$$\therefore v_{TH}=v_{ab}=v-v_x=0.5\text{V}$$

(2) Thévenin equivalent resistance R_{TH}

Let us set all independent sources inside the network to zero first.
Then we force current i_{test} into a. and find the voltage v_{test} across ab. The Thévenin equivalent resistance is simply $R_{TH} = \frac{v_{test}}{i_{test}}$



$$R_{TH} = \frac{v_{test}}{i_{test}} = \frac{v - v_x}{\frac{v_{test}}{40} - \frac{v_x}{10}} = \frac{\frac{-40v_x}{10}}{\frac{-v_x}{10} - \frac{v_x}{10}} = \frac{40}{2} = 20\Omega$$

Note: The relation of v and v_x can be found by applying KCL to node e.

$$-\frac{v}{1} - \frac{v_x}{10} - 2.9v_x = 0$$

$$\Rightarrow v = \frac{-30}{10} v_x$$

v_{TH} = 0.5V, R_{TH} = 20Ω.