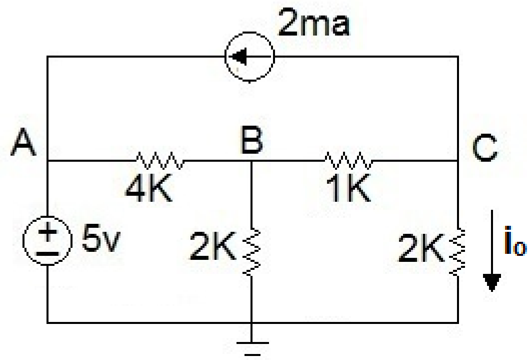
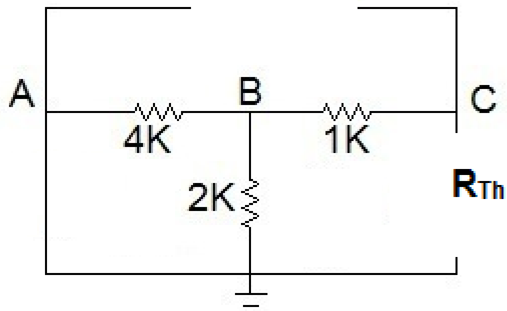
EE 210
Thevenin Examples

1. Find the current i_o using Thevenin's equivalent circuit. Replace the circuit except for the 2K resistor with i_o in it with a Thevenin equivalent.



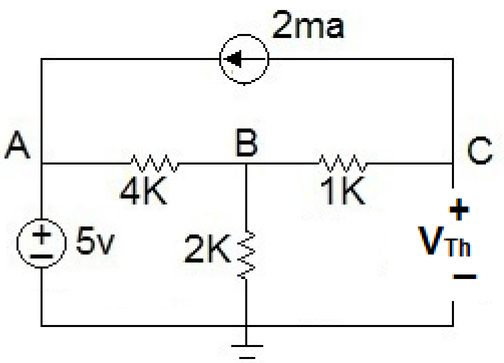
To find R_{th} we note that there are no dependent sources so we can short the voltage source and open the current source.

R_{Th} is seen to be the 1 K resistor in series with the parallel 2K and 4K.



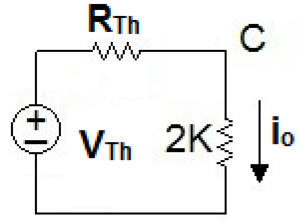
$$R_{Th} = 1 + \frac{2 \cdot 4}{2+4} = 2.33K$$

To get V_{Th} we want the open circuit voltage from node C to ground.



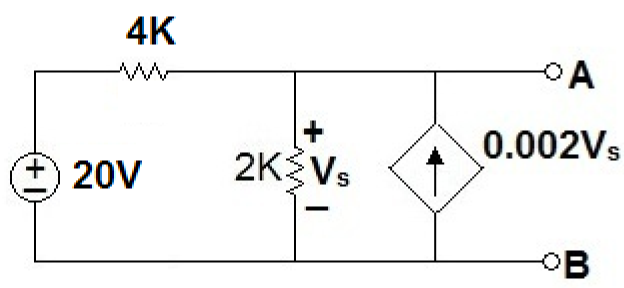
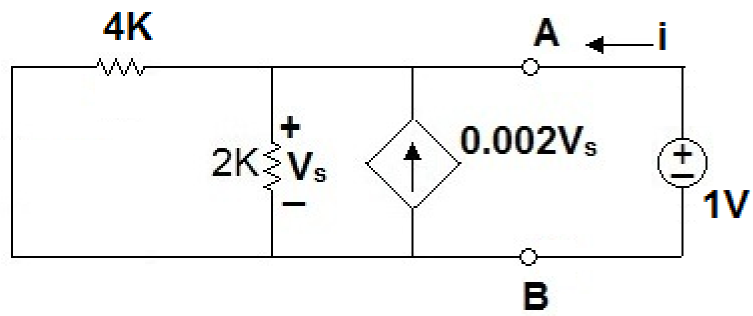
Using nodal analysis we get
At node A:
$V_A = 5$
At node B:
$$\frac{V_B - 5}{4} + \frac{V_B}{2} + 2 = 0$$
At node C:
$$\frac{V_C - V_B}{1} + 2 = 0$$

Solve the Node B equation to get
V_B = -1
Put this in the Node C equation to get
$V_C = V_{Th}$ = -3 volts
The equivalent circuit is shown at right.



$$i_o = \frac{V_{Th}}{R_{Th} + 2} = \frac{-3}{4.33} = -0.693ma$$

2. Find the Thevenin equivalent circuit for the circuit below at terminals A-B.

To get R_{Th} we replace the independent voltage source with a short. We cannot replace the dependent source. When we short the 20 volt source the circuit becomes unsolvable since there is nothing to establish the voltage V_s.	
We can remedy this by placing a 1 volt source at A-B and calculating the current i. $R_{Th} = 1/i$ We see that the voltage at node A is 1 volt and $V_A = V_s$. Summing the currents at node A we get $i + 0.002\overline{V}s - 1/2K - 1/4K = 0$	

This gives i = 0.0005 + 0.00025 – 0.002 = -0.00125 = -1.25 ma
R_{Th} = 1/1.25 = 0.8K

To get V_{Th} we use the original circuit and write the node voltage at node A. This gives

$$\frac{V_A - 20}{4K} + \frac{V_A}{2K} - 0.002V_A = 0$$

$$V_A = V_{Th} = -4 volts$$