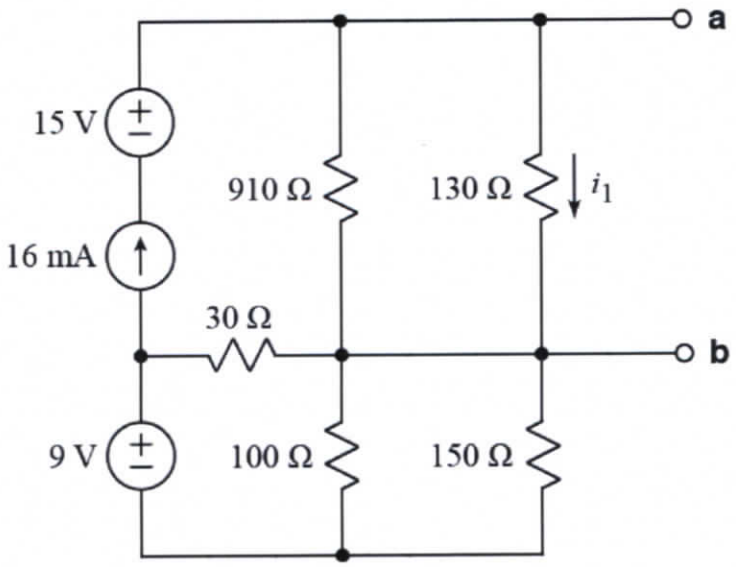
EXAM #1 prob 1 solution

Ex:



a) Calculate i_1. Give your answer as a single numerical value with appropriate units.

b) Find the Thevenin equivalent circuit at terminals **a** and **b**. Express the Thevenin voltage, v_{Th}, and Thevenin resistance, R_{Th} as single numerical values with appropriate units.

soln: a) Because of the 16 mA source, the total current flowing into the $130\Omega \| 910\Omega$ is 16 mA. Thus, we have a current divider.

$$i_1 = 16\,\text{mA}\,\frac{\frac{1}{130\Omega}}{\frac{1}{130\Omega}+\frac{1}{910\Omega}} = 16\,\text{mA}\,\frac{910}{130+910}$$

or

$$i_1 = 16\,\text{mA}\cdot\frac{7}{8}$$

or

$$i_1 = 14\,\text{mA}$$

b) $V_{Th} = V_{a,b}$ with nothing connected to a, b.

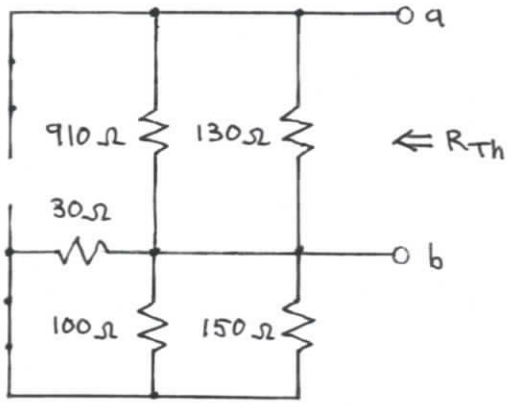
So $v_{Th} = i_1 (130\,\Omega) = 14\,mA\,(130\,\Omega)$

or $v_{Th} = 1.82\,V$

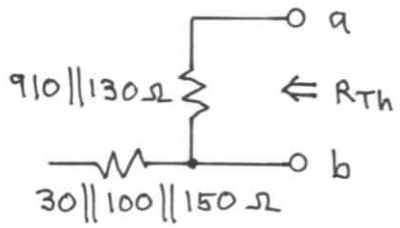
Alternatively, we could use

$$v_{Th} = 16\,mA \cdot 130\,\Omega \| 910\,\Omega = 1.82\,V.$$

To find R_{Th}, turn off independent sources and look into circuit from a, b.



This strange circuit may redrawn as follows:



The bottom R is dangling and may be ignored.

$$R_{Th} = 910 \| 130\,\Omega = 130\,\Omega \cdot 7 \| 1$$

or

$$R_{Th} = 130\,\Omega \cdot \frac{7(1)}{7+1} = 130\,\Omega \left(\frac{7}{8}\right) = 113.75\,\Omega$$