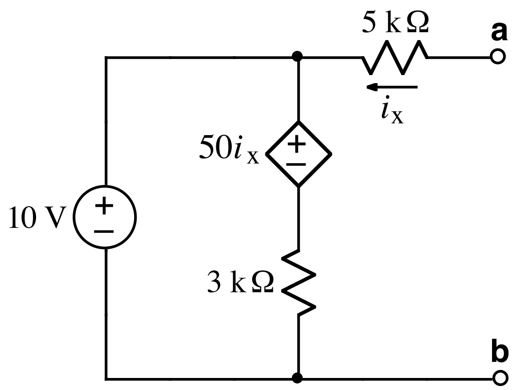
HOMEWORK #17 solution

Ex:



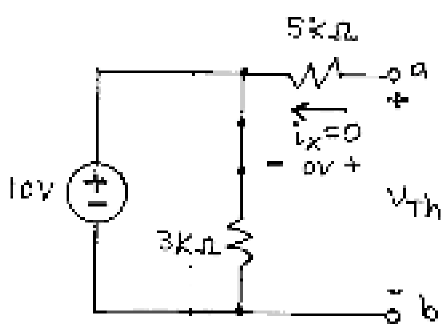
a) Find the Thevenin equivalent of the above circuit relative to terminals **a** and **b**.

b) If we attach R_L to terminals **a** and **b**, find the value of R_L that will absorb maximum power.

c) Calculate the value of that maximum power absorbed by R_L.

sol'n: a) $V_{Th} = V_{a,b}$ no load

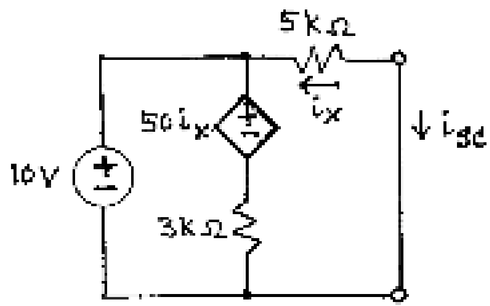
With nothing connected from **a** to **b**, $i_x = 0$ and $50 i_x = 0V$ acts like a wire



Since $i_x = 0$, there is no v-drop across the 5 kΩ resistor. An outer voltage loop reveals that $V_{Th} = 10V$.

Because we have a dependent source, we can find R_{Th} using the formula

$$R_{Th} = \frac{v_{Th}}{i_{sc}}$$



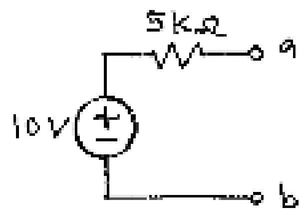
Although we have a dependent source, the 10V source between the top and bottom rails makes the $50 i_x$ and 3kΩ components irrelevant.

From an outer v-loop, we have

$$i_{sc} = \frac{10\text{ V}}{5\text{ k}\Omega} = 2\text{ mA}$$

$$\therefore R_{Th} = \frac{v_{Th}}{i_{sc}} = \frac{10\text{V}}{2\text{ mA}} = 5\text{ k}\Omega$$

Note: The 10V source across the rails allows to ignore the $50 i_x$ and 3kΩ. We may remove them. Then we observe that we are left with the Thevenin equivalent circuit: $V_{Th} = 10V$, $R_{Th} = 5k\Omega$.



b) $R_L = R_{Th} = 5k\Omega$ for max pwr transfer

c) $P_{max} = \frac{V_{Th}^2}{4R_{Th}} = \frac{(10V)^2}{4 \cdot 5k\Omega} = \frac{100}{20}$ mW

$P_{max} = 5$ mW