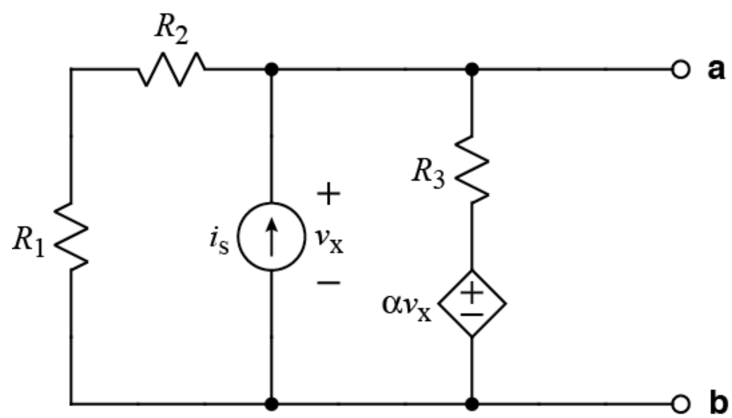
Homework 6

1.



Find the Thevenin equivalent circuit at terminals a-b. v_x must not appear in your solution. The expression must not contain more than circuit parameters α, R_1, R_2, R_3, and i_s. **Note:** $0 < \alpha < 1$.

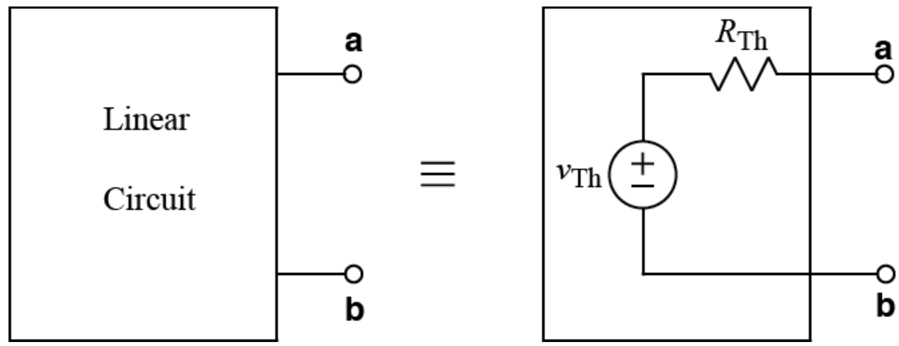
2. Find the Norton equivalent of the circuit in problem 1.

3. For the circuit in problem 1, assume the following component values:
$i_s = 0.4$ mA, $R_1 = 10$ kΩ, $R_2 = 2$ kΩ, $R_3 = 36$ kΩ, $\alpha=2$

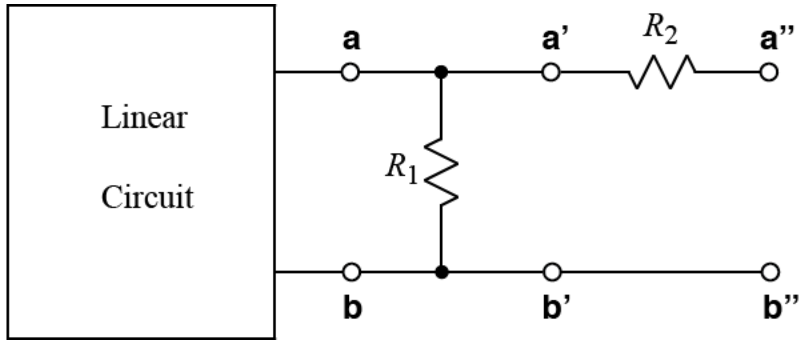
a) Calculate the value of R_L that would absorb maximum power.

b) Calculate that value of maximum power R_L could absorb.

4.



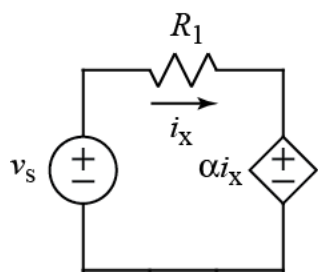
A linear circuit has a Thevenin equivalent, as shown above. Now suppose that components are added to that circuit as shown below.



a) Find the Thevenin equivalent circuit at terminals a'-b' in terms of the original v_{Th} and R_{Th} and the added R_1. (Note that this is the circuit with only R_1 added to it.)

b) Find the Thevenin equivalent circuit at terminals a''-b'' in terms of the original v_{Th} and R_{Th} and the added R_1 and R_2.

5.



Find the equivalent resistance of the dependent source in the above circuit.

Answers:

1. $v_{Th} = i_s \cdot (R_1 + R_2) \parallel R_3 \parallel \dfrac{-R_3}{\alpha} = i_s \cdot R_{Th}$ 2. $i_N = i_s$, $R_N = R_{Th}$

3. a) $R_L = 18\ \text{k}\Omega$ b) $p_{max} = 0.72$ mW

4. a) $v_{Th}' = v_{Th} R_1/(R_1 + R_{Th})$, $R_{Th}' = R_1 \| R_{Th}$ b) $v_{Th}'' = v_{Th}'$, $R_{Th}'' = R_{Th}' + R_2$

5. $R_{Eq} = \alpha$