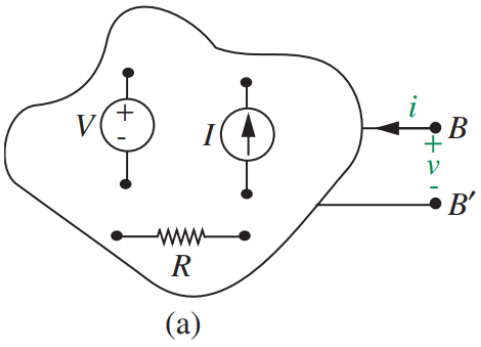
CSE250: Circuits and Electronics
Spring 2023
Practice Problems Set 3

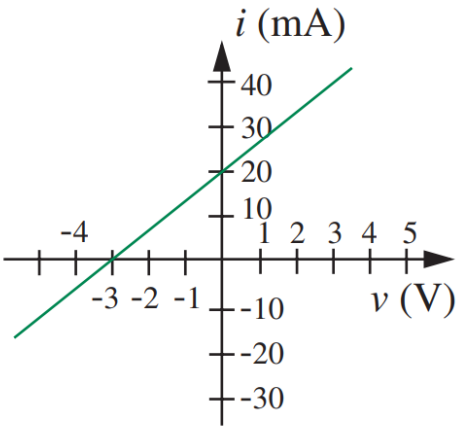
Thevenin's Theorem, Norton's Theorem, and Maximum Power Transfer Theorem

1. Measurements made on terminals $B - B'$ of a linear circuit in (a), which is known to be made up only of independent voltage sources and current sources, and resistors, yield the current-voltage characteristics shown in figure (b).

Find the Thevenin equivalent of this circuit.



(a)



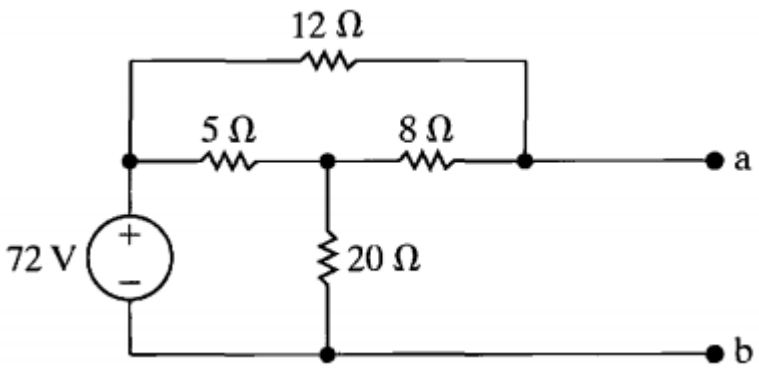
(b)

Answer:

$V_{Th} = -3\,V$

$R_{Th} = \frac{3}{20}\,k\Omega$

2. Find the Thevenin equivalent circuit with respect to the terminals $a,\ b$ for the circuit shown.

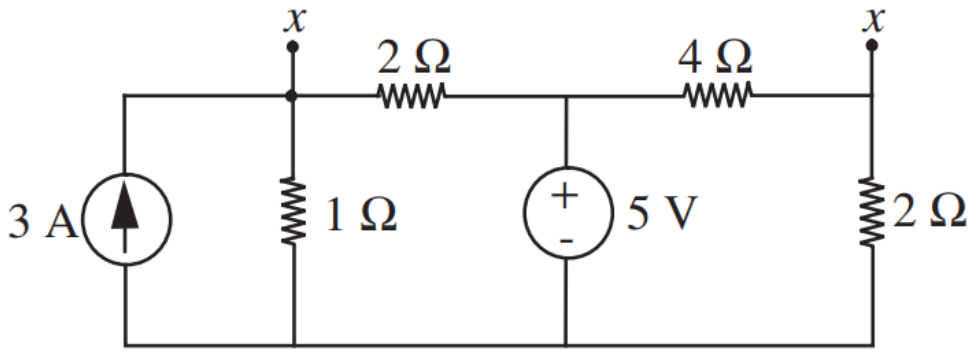


Answer:

$V_{Th} = 64.8\,V$

$R_{Th} = 6\,\Omega$

3. Find the Norton equivalent at the terminals marked $x - x$ in the circuit below.

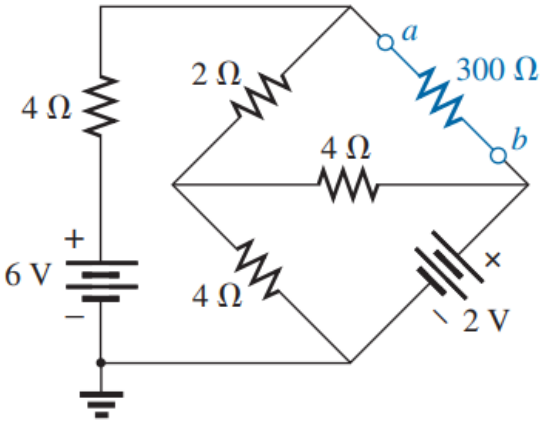


Answer:

$V_{Th} = 2\,V$

$R_{Th} = 2\,\Omega$

4. For the network shown below, find the Thevenin equivalent circuit for the network external to the 300 resistor.



Answer:

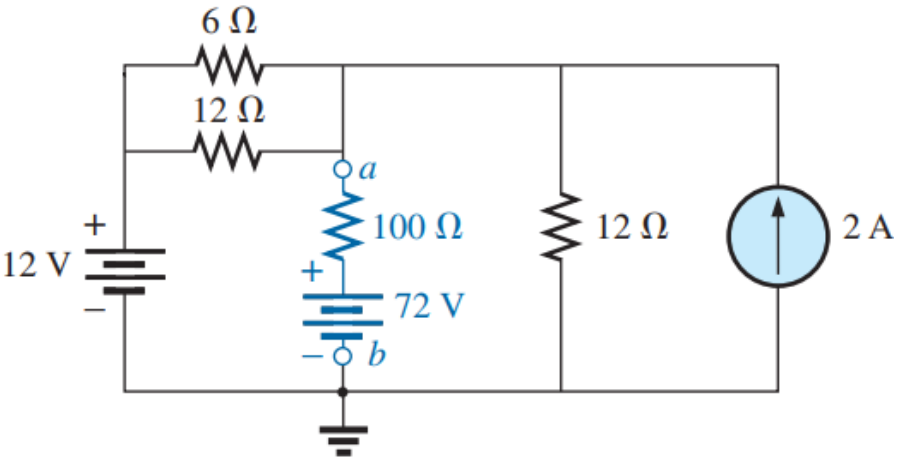
$V_{Th} = 1.5\,V$

$R_{Th} = 2\,\Omega$

5.

i. Find the Norton equivalent circuit external to points a and b.

ii. Find the magnitude and polarity of the voltage across the 100 Ω resistor using the results of part (a).



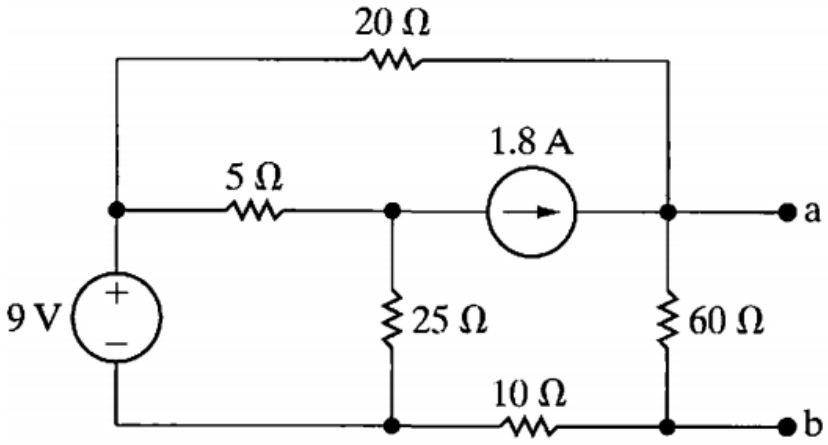
Answer:

$I_N = 5\,A$

$R_{Th} = 3\,\Omega$

$V_{100} = \mp 55.34\,V$

6. Find the Thevenin equivalent with respect to the terminals $a - b$.

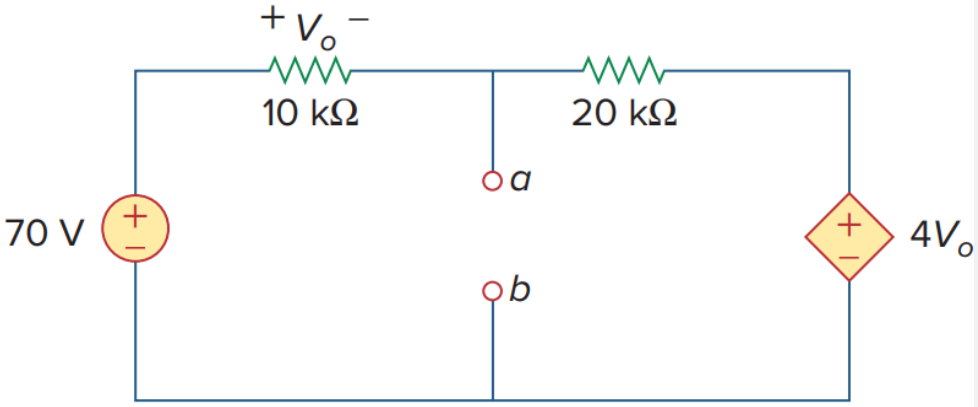


Answer:

$V_{Th} = 30\,V$

$R_{Th} = 20\,\Omega$

7. Find the Thevenin equivalent at terminals $a - b$ of the circuit shown below.

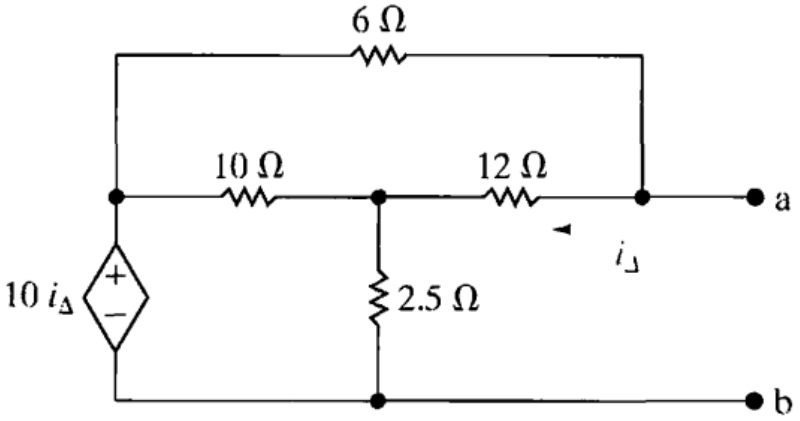


Answer:

$V_{Th} = 60\,V$

$R_{Th} = \frac{20}{7}\,k\Omega$

8. Find the Thevenin equivalent with respect to the terminals $a - b$.



Answer:

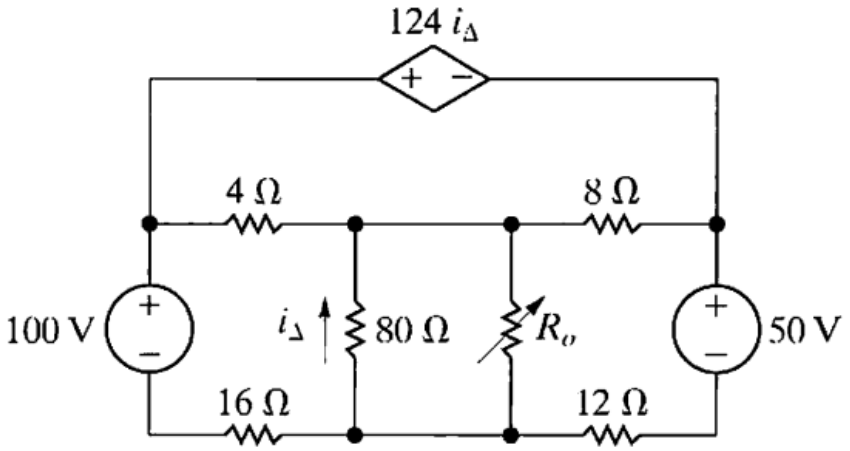
$V_{Th} = 0\,V$

$R_{Th} = 8\,\Omega$

9. The variable resistor (R_o) is adjusted for maximum power transfer to R_o.

i. Find the value of R_o.

ii. Find the maximum power that can be delivered to R_o.



Answer:

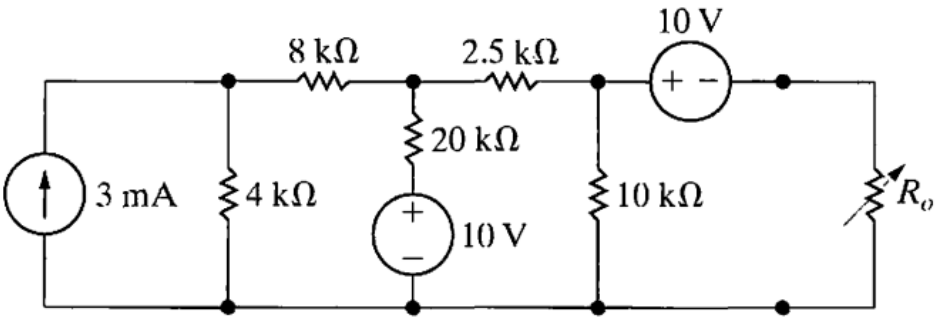
i. $R_o = 6.4\ k\Omega$

ii. $P_{max} = 0.90\ W$

10. The variable resistor (R_o) is adjusted for maximum power transfer to R_o.

i. Find the value of R_o.

ii. Find the maximum power that can be delivered to R_o

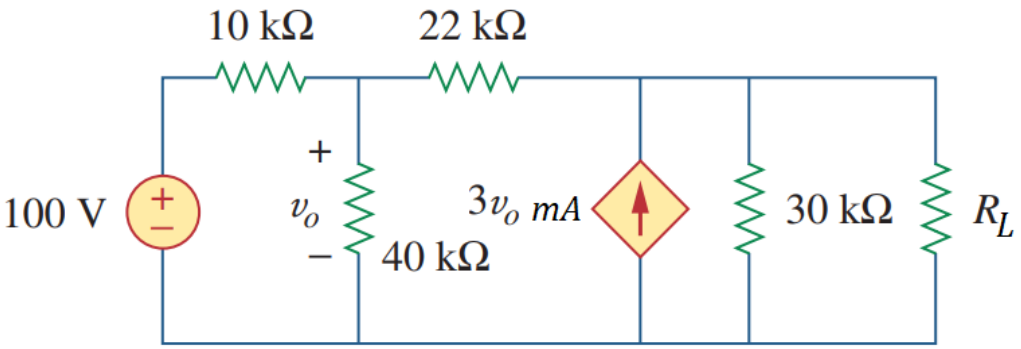


Answer:

i. $R_o = 5\ k$

ii. $P_{max} = 0.957\ mW$

11. Find the maximum power transferred to resistor R_L.



Answer:

$R_L = -0.65\ k\Omega$

$P_{max} = \infty$ $(Theoretically)$