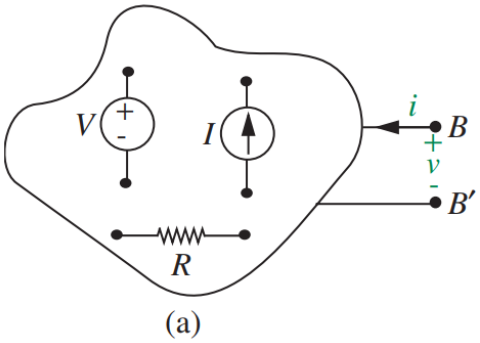
CSE250: Circuits and Electronics
Spring 2023
Practice Problems Set 3

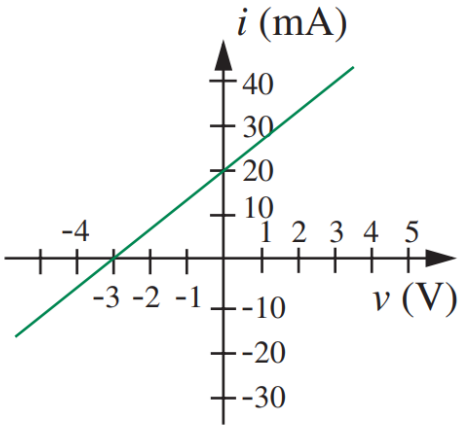
Thevenin's Theorem, Norton's Theorem, and Maximum Power Transfer Theorem

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)



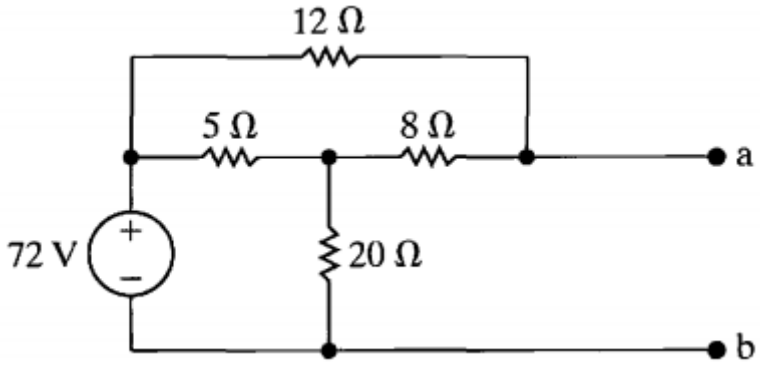
(b)

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.

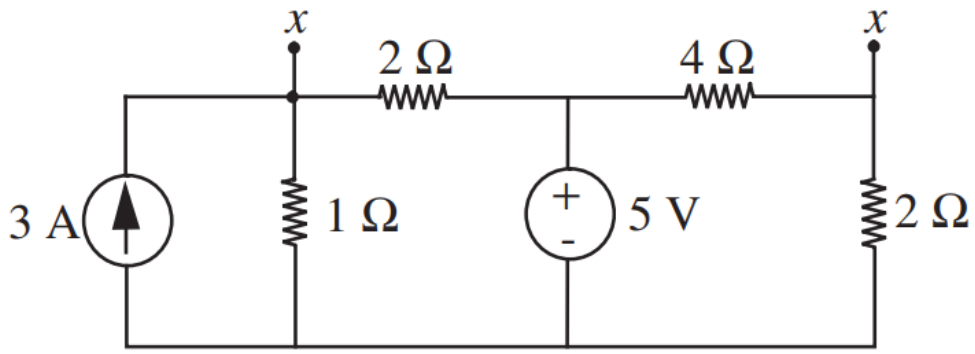


Answer:

$V_{Th} = 64.8\ V$

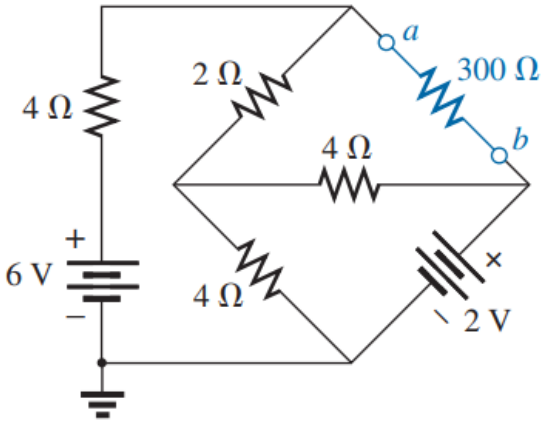
$R_{Th} = 6\ \Omega$

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.

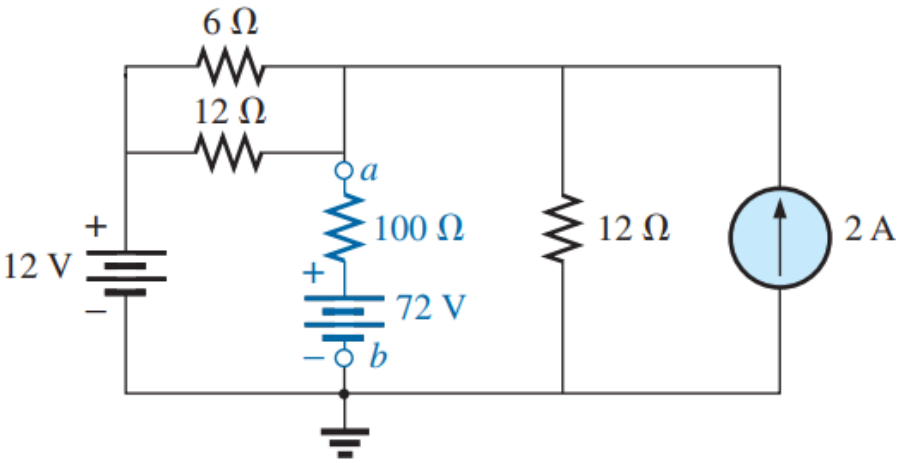


Answer:
$V_{Th} = 1.5\,V$
$R_{Th} = 2\,\Omega$

5.

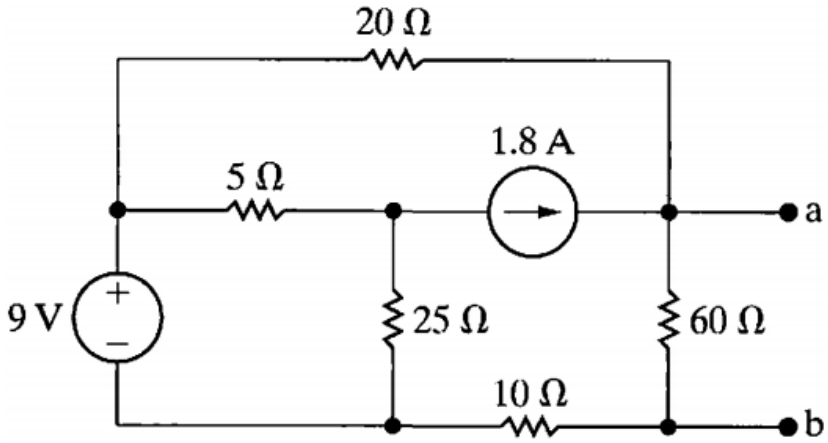
i. Find the Norton equivalent circuit external to points a and b.

ii. Find the magnitude and polarity of the voltage across the 100 ∧ 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 $a - b$.

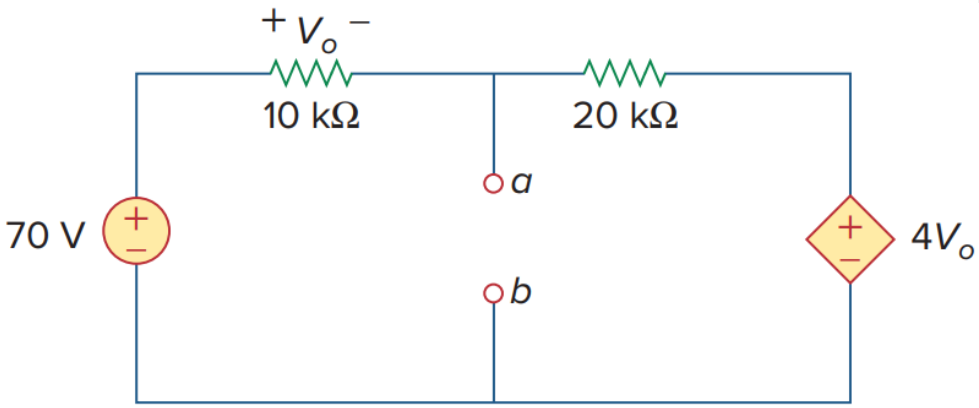


Answer:

$V_{Th} = 30\ V$

$R_{Th} = 20\ \Omega$

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

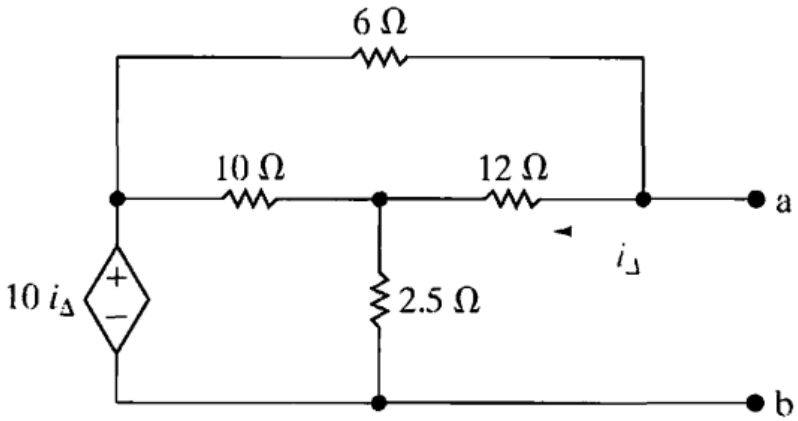


Answer:

$V_{Th} = 60\ V$

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

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



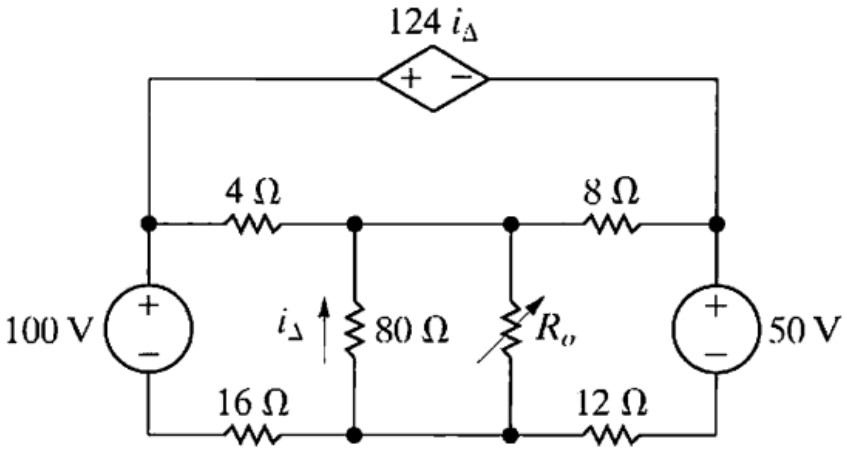
Answer:

$V_{Th} = 0\ V$

$R_{Th} = 8\ \Omega$

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

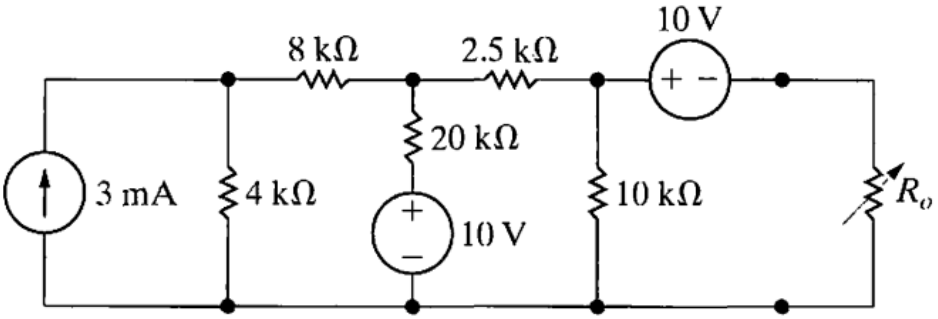
i. Find the value of R_o.
ii. Find the maximum power that can be delivered to R_o.



Answer:
i. $R_o = 6.4\ k\Omega$
ii. $P_{max} = 0.90\ W$

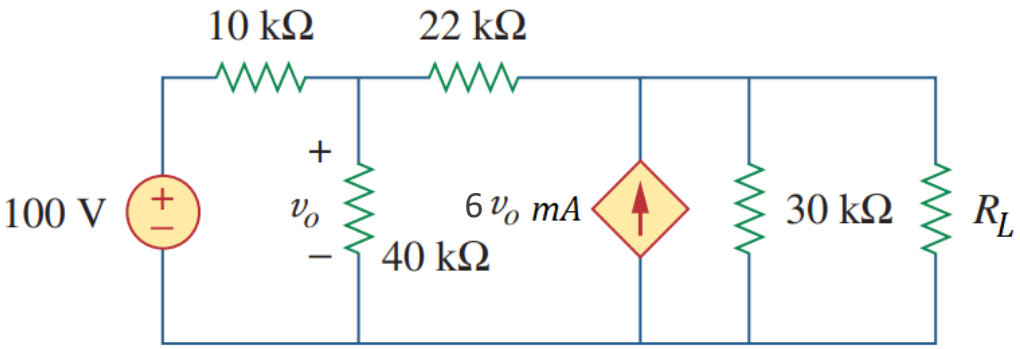
10. The variable resistor (R_o) is adjusted for maximum power transfer to R_o.

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:

$R_L = -0.65\ k\Omega$

$P_{max} = \infty$

$(Theoretically)$