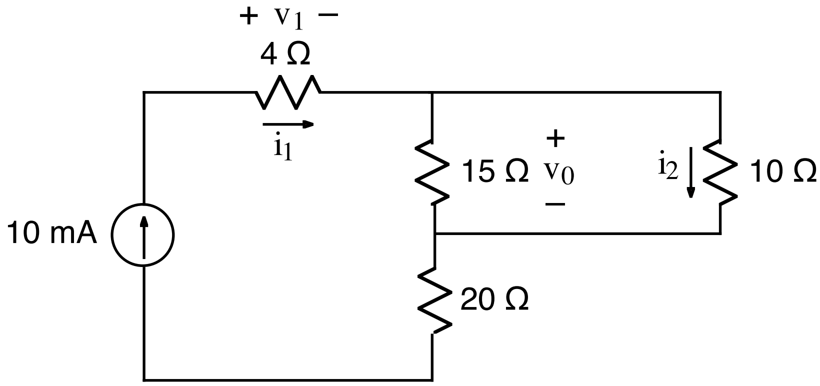
HOMEWORK #3 solution

THE UNIVERSITY OF UTAH

Ex:



Calculate i_1, i_2, and v_0.

sol'n: Starting with v-loops, we observe that v-loops passing thru the 10mA source would require defining a voltage drop for a current source. This is unconstructive, as it adds an eqn and an unknown value.

Thus, we use only the v-loop on the right:

$$+v_0 - v_2 = 0V \quad \text{or} \quad v_2 = v_0$$

This means components in parallel have the same voltage drop.

Turning to currents, we observe that 10 mA from the i-source flows thru the 4Ω and 20Ω resistors.

$$i_1 = i_3 = 10 \text{ mA}$$

From Ohm's law, we have $v_1 = 10mA \cdot 4\Omega = 40mV$

$v_3 = 10mA \cdot 20\Omega = 200mV$

For current sums, we consider the top-center node:

$$-i_1 + i_0 + i_2 = 0\,A$$

or $$-10\,mA + i_0 + i_2 = 0\,A$$

or $$i_0 + i_2 = 10\,mA$$

Using Ohm's law, we have eq'ns for i_0 and i_2:

$$v_0 = i_0 \cdot 15\,\Omega \qquad v_2 = i_2 \cdot 10\,\Omega = v_0$$

Substituting into the current eq'n, we have

$$\frac{v_0}{15\,\Omega} + \frac{v_0}{10\,\Omega} = 10\,mA$$

or $$v_0 \left(\frac{1}{15\,\Omega} + \frac{1}{10\,\Omega} \right) = 10\,mA$$

or $$v_0 = 10\,mA \cdot \frac{1}{\frac{1}{15\,\Omega} + \frac{1}{10\,\Omega}}$$

$$= 10\,mA \cdot \frac{10\,\Omega \cdot 15\,\Omega}{10\,\Omega + 15\,\Omega}$$

$$v_0 = 10\,mA \cdot 6\,\Omega = 60\,mV$$

Using Ohm's law, we have

$$i_2 = \frac{v_0}{10\,\Omega} = \frac{60\,mV}{10\,\Omega} = 6\,mA$$