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 extra and an unknown value.

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

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

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:

$$v_1 = 10 \text{ mA} \cdot 4 \Omega = 40 \text{ mV}$$

$$v_2 = 10 \text{ mA} \cdot 20 \Omega = 200 \text{ mV}$$
For current sums, we consider the top-center node:

\[-i_1 + i_0 + i_2 = 0 \text{A}\]

or \[-10 \text{mA} + i_0 + i_2 = 0 \text{A}\]

or \[i_0 + i_2 = 10 \text{mA}\]

Using Ohm's law, we have eqns for \(i_0\) and \(i_2\):

\[V_0 = i_0 \cdot 15 \Omega \quad V_2 = i_2 \cdot 10 \Omega = V_0\]

Substituting into the current eqn, we have

\[\frac{V_0}{15 \Omega} + \frac{V_0}{10 \Omega} = 10 \text{mA}\]

or \[V_0 \left(\frac{1}{15 \Omega} + \frac{1}{10 \Omega}\right) = 10 \text{mA}\]

or \[V_0 = 10 \text{mA} \cdot \frac{1}{\frac{1}{15 \Omega} + \frac{1}{10 \Omega}}\]

\[= 10 \text{mA} \cdot \frac{10 \Omega \cdot 15 \Omega}{10 \Omega + 15 \Omega}\]

\[V_0 = 10 \text{mA} \cdot 6 \Omega = 60 \text{mV}\]

using Ohm's law, we have

\[i_2 = \frac{V_0}{10 \Omega} = \frac{60 \text{mV}}{10 \Omega} = 6 \text{mA}\]