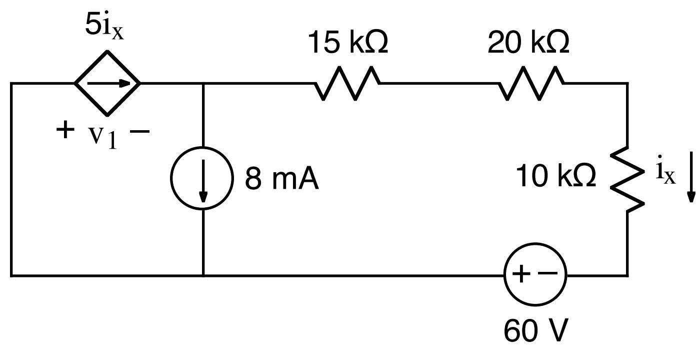
Ex:



Find i_x, v_1, and the power dissipated by the dependent source.

sol'n: First, we observe that i_x flows thru all 3 resistors since they are in series.

Rather than defining voltages for every resistor, we may use Ohm's law directly to define the voltages as $v = iR$. Note that the + and − signs of the voltage measurements must obey the passive sign convention: the current arrow must point toward the − sign of the v-drop measurement.

Turning to v-loop eqns, we discover that all loops pass thru current sources, meaning we should avoid writing those v-loop eqns.

Note: even though the dependent current source is labeled with a v-drop, we should avoid using v_1 in a v-loop. Instead, we can solve the circuit first and then find v_1.

We now write a current-sum eq'n for the top-center node:

$$-5i_x + 8\text{ mA} + i_x = 0\text{ A}$$

or $\quad 4i_x = 8\text{ mA}$

or $\quad i_x = 2\text{ mA}$

Now we use a v-loop around the outside of the circuit to find v_1:

$$-v_1 - i_x\,15\text{ k}\Omega - i_x\,20\text{ k}\Omega - i_x\,10\text{ k}\Omega + 60\text{V} = 0\text{V}$$

or $\quad v_1 = -i_x(15\text{ k}\Omega + 20\text{ k}\Omega + 10\text{ k}\Omega) + 60\text{V}$

$$= -2\text{mA} \cdot 45\text{ k}\Omega + 60\text{V}$$

$$= -90\text{V} + 60\text{V}$$

$$v_1 = -30\text{V}$$

The power for the dependent source is

$$p = i \cdot v = 5i_x\,v_1 = 5(2\text{mA})(-30\text{V})$$

$$p = -300\text{ mW}$$