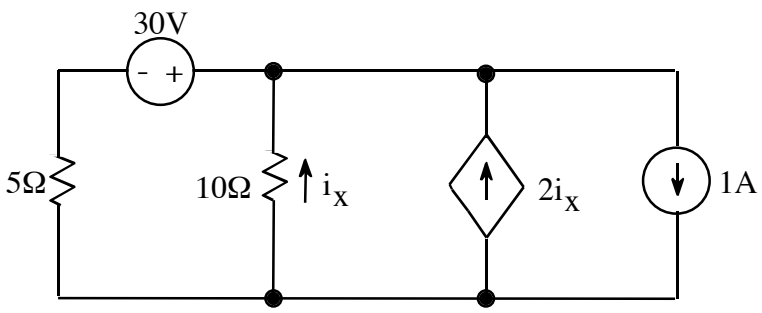
3.



Calculate the power furnished or absorbed by the 30V voltage source, and state whether it is furnished or absorbed.

Solution:

Because there are several current sources, the node-V method is a good choice here. For node v_1:

$$\frac{v_1 - 30\ \text{V}}{5\ \Omega} + \frac{v_1}{10\ \Omega} - 2\,i_x + 1\ \text{A} = 0\ \text{A}$$

Our constraint equation: $i_x = -\dfrac{v_1}{10\ \Omega}$. Substitute this into the node v_1 equation:

$$\frac{v_1 - 30\ \text{V}}{5\ \Omega} + \frac{v_1}{10\ \Omega} + \frac{2v_1}{10\ \Omega} + 1\ \text{A} = 0\ \text{A}$$

or

$$v_1\left(\frac{1}{5\ \Omega} + \frac{3}{10\ \Omega}\right) = \frac{30\ \text{V}}{5\ \Omega} - 1\ \text{A} = 5\ \text{A}$$

or

$$v_1 = 5\ \text{A}\cdot 5\ \Omega \left\| \frac{10}{3}\Omega = 5\ \text{A}\cdot 5\ \Omega\cdot 1 \right\| \frac{2}{3}$$

or

$$v_1 = 25\ \text{V}\cdot\frac{2/3}{5/3} = 10\ \text{V}$$

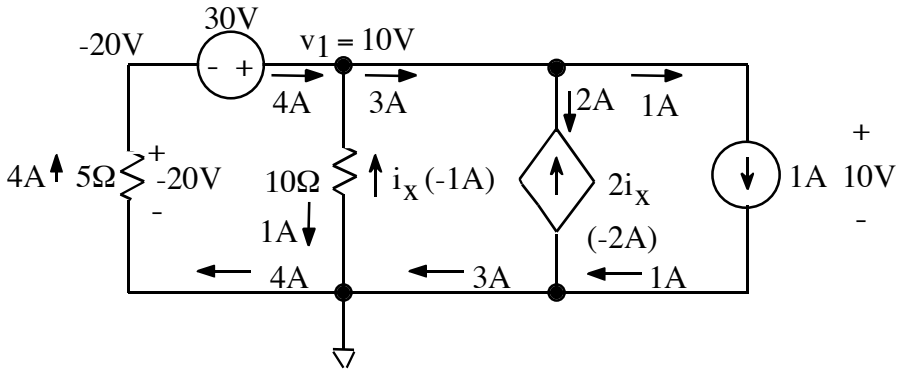
Current i flowing from + to - in 30 V source:

$$i = \frac{v_1 - 30\ \text{V}}{5\ \Omega} = \frac{10\ \text{V} - 30\ \text{V}}{5\ \Omega} = -\frac{20\ \text{V}}{5\ \Omega} = -4\ \text{A}$$

$$\text{Power} = i \cdot v = -4\ \text{A} \cdot 30\ \text{V} = -120\ \text{W} < 0 \Rightarrow \text{pwr furnished}$$

Power 120 W furnished (or delivered)

Check: Calculate all i's and v's and verify Kirchhoff's laws.



All sums of currents out of nodes = 0 A ✓

All sums of V-drops around loops = 0 V ✓