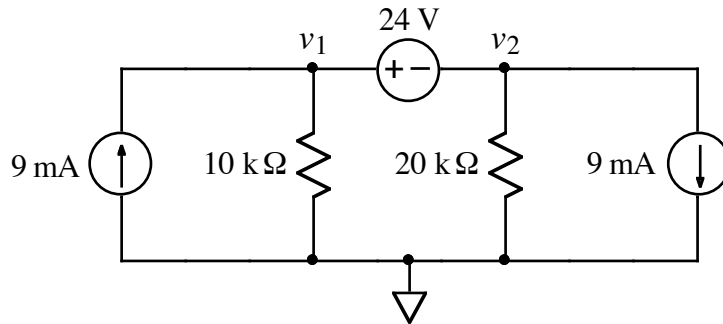


Ex:



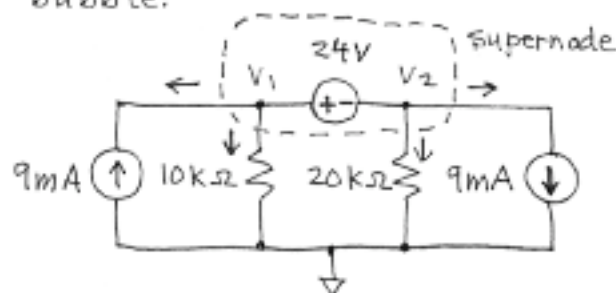
Use the node-voltage method to find v_1 and v_2 .

SOL'N: We sum the currents out of each node.

$$v_1 \text{ node: } -9 \text{ mA} + \frac{v_1}{10 \text{ k}\Omega} + ? = 0 \text{ A}$$

$$v_2 \text{ node: } -? + \frac{v_2}{20 \text{ k}\Omega} + 9 \text{ mA} = 0 \text{ A}$$

The ? represents an unknown current flowing from left to right in the 24V source. What we have encountered is a supernode. For this we use a new method of solution: we draw a bubble around the v_1 and v_2 nodes and 24V source. Then we sum the currents out of this bubble.



The sum of currents out of the supernode is as follows:

$$-9\text{mA} + \frac{V_1}{10\text{k}\Omega} + \frac{V_2}{20\text{k}\Omega} + 9\text{mA} = 0\text{A}$$

Note that this eq'n is the sum of the first eq'ns set down in this solution.

The supernode eq'n is only one eq'n for two nodes, leaving us in need of another eq'n for these two nodes. The solution to this problem is to write a voltage eq'n for the two nodes.

$$V_1 - V_2 = 24\text{V}$$

Note: In this eq'n we have $+V_1$ and $-V_2$ with signs being the same as the sign in the 24V source next to the node.

Now we solve our two eq'ns. Multiplying the eq'n at the top of the page by 20k Ω yields the following eq'n:

$$2V_1 + V_2 = 0\text{V} \quad \text{or} \quad V_2 = -2V_1$$

Using this in our other eq'n yields V_1 :

$$V_1 - (-2V_1) = 24\text{V} \quad \text{or} \quad V_1 = \frac{24\text{V}}{3} = 8\text{V}$$

and $V_2 = -2V_1 = -16\text{V}$.