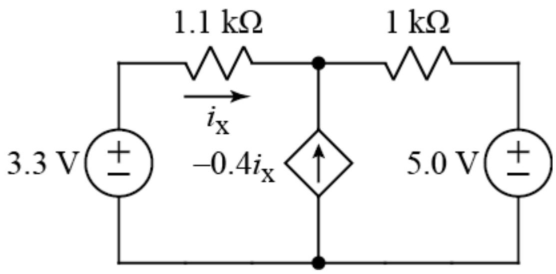
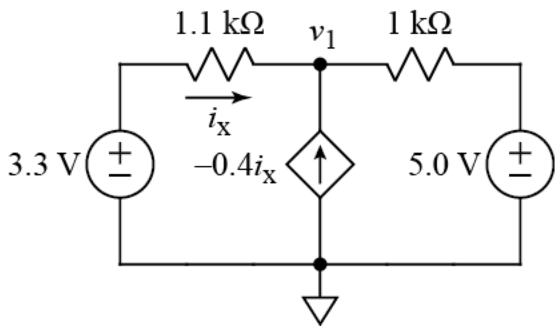
Ex:



Calculate the power consumed (i.e., dissipated) by the 3.3 V source. **Note:** If a source supplies power, the power it consumes is negative.

SOL'N: Any valid method of solution may be used. Here, the node-voltage method is used. We define a reference node and a v_1 node.



We define the variable, i_x, for the dependent source in terms of the node-voltage.

$$i_x = \frac{3.3\text{ V} - v_1}{1.1\text{k}\Omega}$$

Now we sum the current out of the v_1 node.

$$\frac{v_1 - 3.3\text{ V}}{1.1\text{k}\Omega} - -0.4\left(\frac{3.3\text{ V} - v_1}{1.1\text{k}\Omega}\right) + \frac{v_1 - 5.0\text{ V}}{1\text{k}\Omega} = 0\text{ A}$$

or

$$v_1\left(\frac{1}{1.1\text{k}\Omega} - 0.4\frac{1}{1.1\text{k}\Omega} + \frac{1}{1\text{k}\Omega}\right) = \frac{3.3\text{ V}}{1.1\text{k}\Omega} - 0.4\frac{3.3\text{ V}}{1.1\text{k}\Omega} + \frac{5.0\text{ V}}{1\text{k}\Omega}$$

or, if we multiply both sides by 1.1 kΩ

$$v_1(1 - 0.4 + 1.1) = 3.3\text{V} + 0.4(3.3\text{V}) + 5.5\text{V}$$

or

$$v_1(1.7) = 1.98 + 5.5\,\text{V} = 7.48\,\text{V}$$

or

$$v_1 = \frac{7.48\,\text{V}}{1.7} = 4.4\,\text{V}$$

The power in the 3.3 V source is $p = -i_x \cdot 3.3\text{V}$. We now calculate i_x.

$$i_x = \frac{3.3\ \text{V} - 4.4\,\text{V}}{1.1\,\text{k}\Omega} = -1\,\text{mA}$$

Finally, we calculate the power:

$$p = iv = -i_x\, 3.3\,\text{V} = 1\,\text{mA} \cdot 3.3\,\text{V} = 3.3\,\text{mW}$$