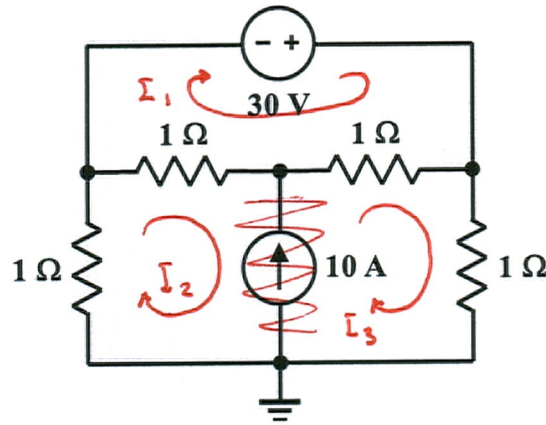


Homework Problem #10



- a. Develop mesh equations and express them in the standard matrix form.

$$I_3 - I_2 = 10 \text{ A} \quad (\text{constraint equation for the } 10 \text{ A source})$$

$$-30 \text{ V} + 1(I_1 - I_3) + 1(I_1 - I_2) = 0 \quad (\text{KVL for mesh 1})$$

$$1(I_2 - I_1) + 1(I_3 - I_1) + 1I_3 + 1I_2 = 0 \quad (\text{KVL for mesh 2, 3})$$

In matrix form:

$$\begin{bmatrix} 0 & -1 & 1 \\ 2 & -1 & -1 \\ -2 & 2 & 2 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 10 \\ 30 \\ 0 \end{bmatrix}$$

- b. Solve the equations and determine whether the 30 V source is *delivering* or *absorbing* power, and how much.

Solving yields:

$$I_1 = 30 \text{ A}, \quad I_2 = 10 \text{ A}, \quad I_3 = 20 \text{ A}$$

The passive sign convention is not satisfied,
so the 30V source delivers

$$(30 \text{ V}) I_1 = 900 \text{ W}$$