Student Name: SalahDin Rezk
Student ID: 202201079
Date: November 4, 2023

Electric Circuits (ENGR210)
Assignment 2

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1. If the interconnection in Figure 1 is valid, find the total power developed in the circuit. If the interconnection is not valid, explain why.

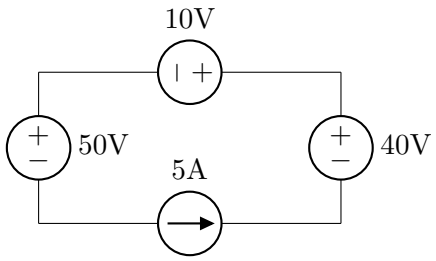

Figure 1

KVL on loop:

$$-50 - 10 + 40 + V_{\text{source}} = 0 \tag{1}$$
$$V_{\text{source}} = 20 \text{ V}. \tag{2}$$

$$40 \times -5 = -200 \text{ W} \tag{3}$$
$$10 \times 5 = 50 \text{ W} \tag{4}$$
$$50 \times 5 = 250 \text{ W} \tag{5}$$
$$-20 \times 5 = -100 \text{ W} \tag{6}$$
$$\Sigma P = -200 + 50 + 250 - 100 \tag{7}$$
$$= 0. \tag{8}$$

2. The interconnection of ideal sources can lead to an indeterminate solution. With this thought in mind, explain why the solutions for $v1$ and $v2$ in the circuit in Figure 2 are not unique.

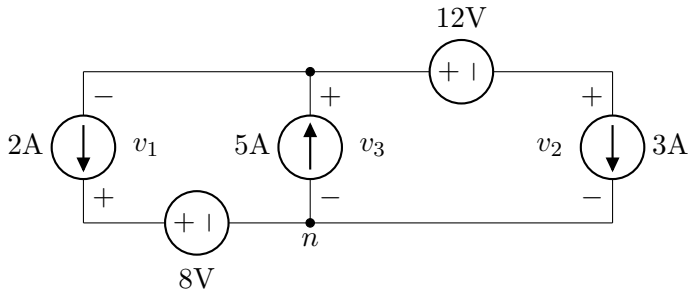

Figure 2

KCL at node n:

$$\Sigma I = 0 \tag{9}$$

$$3 + 2 - 5 = 0 \implies \text{System is valid.} \tag{10}$$

KVL on loop:

$$12 - v_3 + v_2 = 0 \tag{11}$$

$$v_1 - 8 + v_3 = 0. \tag{12}$$

From (11) and (12) the system of equations is free and there is no unique solution.

3. The current i_x the circuit shown in Figure 3 is 50 mA and the voltage v_x is 3.5 V. Find

$$i_x = 50 \text{ mA} \quad v_x = 3.5 \text{ V}. \tag{13}$$

(a) i_1.

$$\begin{aligned} i_1 &= \frac{v_x}{R} && (14)\\ &= \frac{3.5}{175} && (15)\\ &= 20 \text{ mA}. && (16) \end{aligned}$$

(b) v_1.
Applying KCL:

$$\begin{aligned} i_x &= i_1 + i_2 && (17)\\ 50 &= 20 + i_2 && (18)\\ i_2 &= 30 \text{ mA}. && (19) \end{aligned}$$

$$\begin{aligned} v_1 &= i_2 \times R && (20)\\ &= 30 \times 10^{-3} \times 250 && (21)\\ &= 7.5 \text{ V}. && (22) \end{aligned}$$

(c) v_g.
Using KVL:

$$v_1 + 50i_x - v_g = 0. \tag{23}$$

$$\begin{aligned} v_g &= v_1 + 50i_x && (24)\\ &= 7.5 + 50 \times 50 \times 10^{-3} && (25)\\ &= 10 \text{ V}. && (26) \end{aligned}$$

(d) the power supplied by the voltage source.

$$\begin{aligned} P = v_g i_x &= 10 \times 50 \times 10^{-3} && (27)\\ &= 0.5 \text{ W}. && (28) \end{aligned}$$

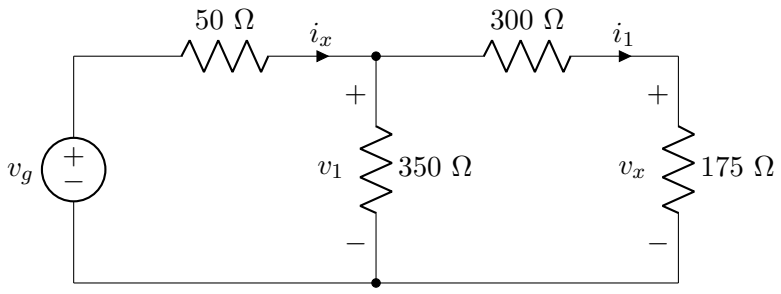

Figure 3