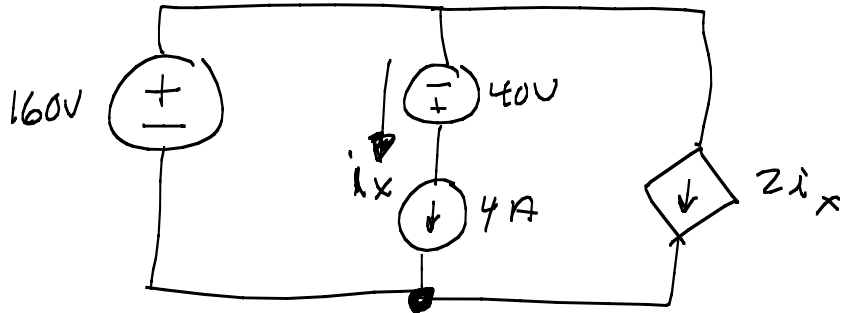


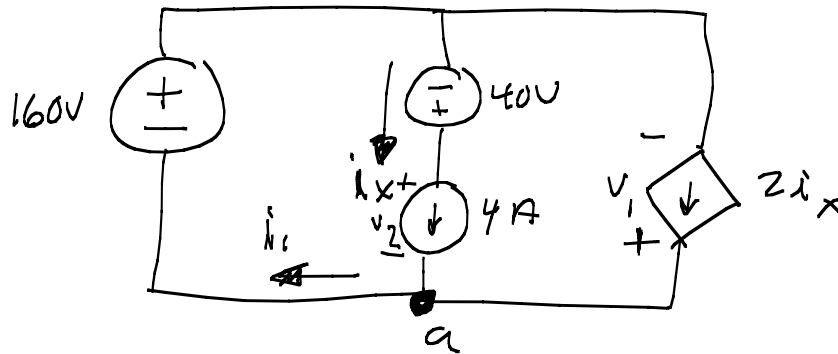
Kirchhoff's Laws

Problem Statement:

Show that the total power developed is equal to the total power absorbed.



1.) Label all currents and voltages.

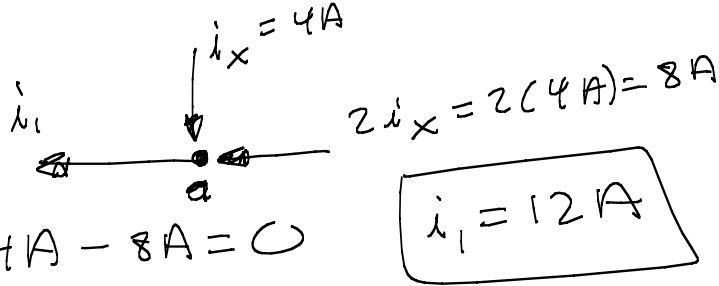


2.) Select loops and/or nodes.

$KCL(a) \Rightarrow i_1$
 $KVL(Left) \Rightarrow v_2$
 $KVL(Perimeter) \Rightarrow v_1$

3.) Apply Kirchhoff's Laws.

KCL Node a



$$i_1 - 4A - 8A = 0$$

$i_1 = 12A$

KVL (Left, cw)

$$-160V - 40V + v_2 = 0$$

$v_2 = 200V$

KVL (Perimeter, cw)

$$-160V - v_1 = 0$$

$v_1 = -160V$

4.) Return to the original circuit and solve for the currents, voltages, and power.

$$P_{160V} = -vi = -(160V)(12A) = -1920W \text{ (developed)}$$

$$P_{40V} = -vi = -(40V)(4A) = -160W \text{ (developed)}$$

$$P_{4A} = vi = (200V)(4A) = 800W \text{ (absorbed)}$$

$$P_{2ix} = -vi = -(-160V)(8A) = 1280W \text{ (absorbed)}$$

$$P_{\text{developed}} = 1920W + 160W = 2080W$$

$$P_{\text{absorbed}} = 800W + 1280W = 2080W$$

$$P_{\text{developed}} = P_{\text{absorbed}}$$