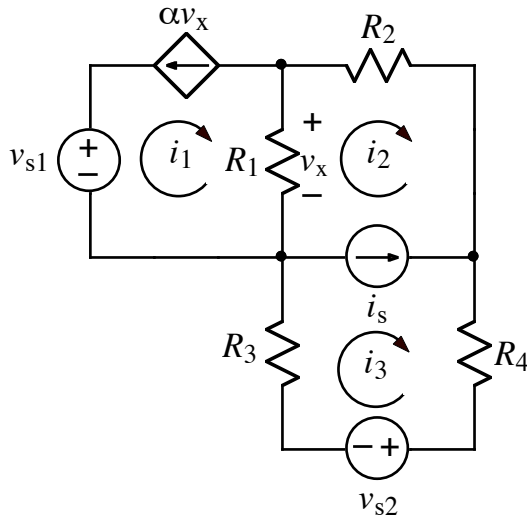


Ex:



For the circuit shown, write three independent equations for the three mesh currents  $i_1$ ,  $i_2$ , and  $i_3$ . The quantity  $v_x$  must not appear in the equations.

**SOL'N:** We first define the variable for the dependent source in terms of mesh currents:

$$v_x = (i_1 - i_2)R_1$$

Since the dependent current source is on the outside edge of the circuit,  $i_1$  is equal to  $\alpha v_x$  (but in the opposite direction).

$$i_1 = -\alpha(i_1 - i_2)R_1$$

For  $i_2$  and  $i_3$ , we have a super-mesh. Thus, we take a voltage loop around the outside of the  $i_2$  and  $i_3$  loops. We also write an equation for the  $i_s$  source in terms of  $i_2$  and  $i_3$ .

$$-i_3R_3 - i_2R_1 + i_1R_1 - i_2R_2 - i_3R_4 = 0 \text{ V}$$

$$i_s = i_3 - i_2$$