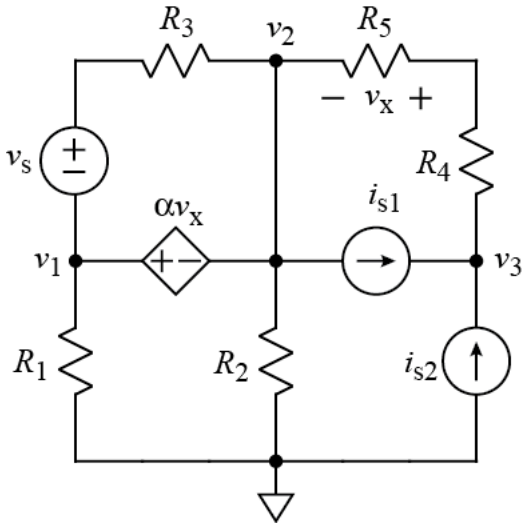
EX:



For the circuit shown, write three independent equations for the node-voltages, v_1, v_2, and v_3. The quantity v_x must not appear in the equations. Only component and source names may appear in answer.

SOL'N:

Supernode between V_1 and V_2:

① $(V_1 - V_2) = \alpha V_x$

$$V_x = -\frac{(V_2 - V_3)R_5}{R_4 + R_5}$$

① $$(V_1 - V_2) = -\alpha \frac{R_5(V_2 - V_3)}{R_4 + R_5}$$

② $$\frac{V_1}{R_1} + \frac{(V_1 + V_S - V_2)}{R_3} - \frac{(V_1 + V_S - V_2)}{R_3} + \frac{V_2}{R_2} + I_{S1} + \frac{(V_2 - V_3)}{R_4 + R_5} = 0$$

at node V_3:

③ $$-I_{S1} - I_{S2} - \frac{(V_2 - V_3)}{R_4 + R_5} = 0$$