Problem 3.71 Find the Thévenin equivalent circuit at terminals (a,b) of the circuit in Fig. P3.71.

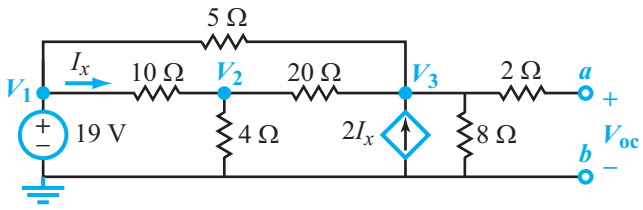


Figure P3.71: Circuit for Problems 3.71 and 3.72.

Solution:

$$V_1 = 19 \text{ V}$$

$$\frac{V_2 - V_1}{10} + \frac{V_2}{4} + \frac{V_2 - V_3}{20} = 0$$

$$\frac{V_3 - V_2}{20} + \frac{V_3}{8} + \frac{V_3 - V_1}{5} - 2I_x = 0$$

$$I_x = \frac{V_1 - V_2}{10}$$

Simultaneous solution of the above equations yields:

$$V_2 = 6.94 \text{ V}, \qquad V_3 = 17.49 \text{ V}.$$

$$V_{\text{Th}} = V_{\text{oc}} = V_3 = 17.49 \text{ V}.$$

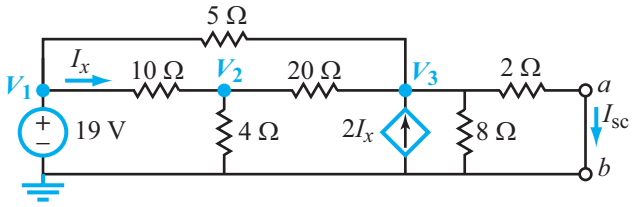
To find R_{Th}, we calculate I_{sc}:

$$V_1 = 19 \text{ V}$$

$$\frac{V_2 - V_1}{10} + \frac{V_2}{4} - \frac{V_2 - V_3}{20} = 0$$

$$\frac{V_3 - V_2}{20} + \frac{V_3}{8} + \frac{V_3}{2} + \frac{V_3 - V_1}{5} - 2I_x = 0$$

$$I_x = \frac{V_1 - V_2}{10}$$



Solution is: $V_2 = 5.71$ V, $V_3 = 7.71$ V.

$$I_{\text{sc}} = \frac{V_3}{2} = \frac{7.71}{2} = 3.86 \text{ A}.$$

$$R_{\text{Th}} = \frac{V_{\text{oc}}}{I_{\text{sc}}} = \frac{17.49}{3.86} = 4.53 \ \Omega.$$

Hence, the Thévenin circuit is