Exercise 3-13 Find the Norton equivalent at terminals (a,b) of the circuit in Fig. E3-13.

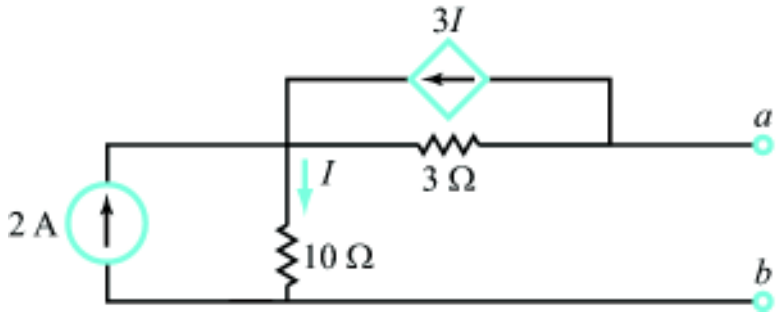
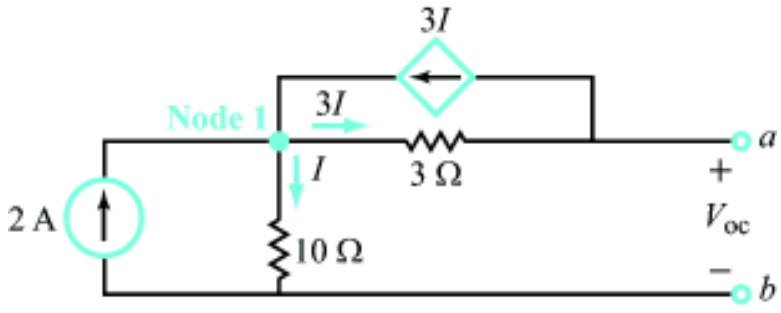


Figure E3-13

Solution: Thévenin voltage



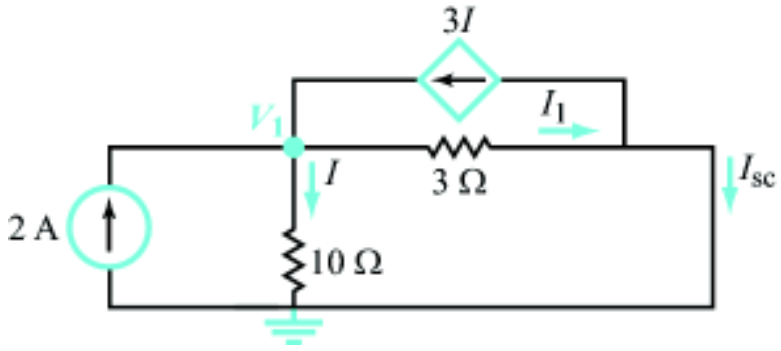
At node 1:

$$I = 2 \text{ A}.$$

Hence,

$$V_{\text{Th}} = V_{\text{oc}} = 10I - 3 \times 3I = I = 2 \text{ V}.$$

Next, we determine the short-circuit current:



At node V_1:

$$-2-3I+\frac{V_1}{10}+\frac{V_1}{3}=0.$$

Also,

$$I=\frac{V_1}{10}\,.$$

Hence,

$$-2-3I+I+\frac{10}{3}\,I=0,$$

which gives

$$\begin{aligned} I &= 1.5 \text{ A}, \\ I_1 &= 2+3I-I=2+2I=5 \text{ A}, \\ I_{\text{sc}} &= 5-3I=5-4.5=0.5 \text{ A}. \\ R_{\text{Th}} &= \frac{V_{\text{Th}}}{I_{\text{sc}}}=\frac{2}{0.5}=4\ \Omega. \end{aligned}$$

Norton circuit is: