Chapter 5, Solution 18.

For the circuit, shown in Fig. 5.57, solve for the Thevenin equivalent circuit looking into terminals A and B.

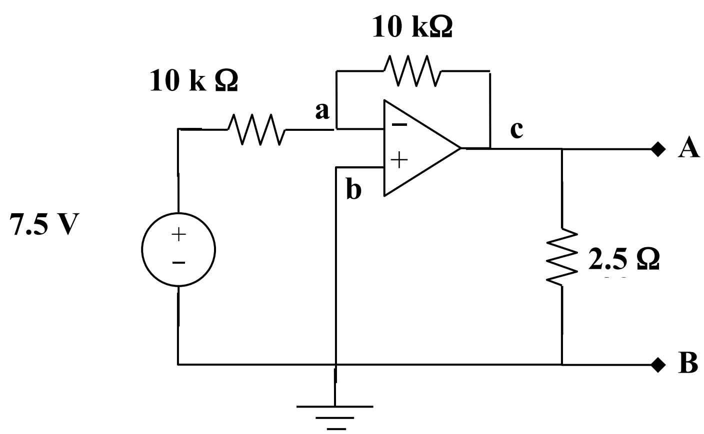

Figure 5.57
For Prob. 5.18.

Solution

Write a node equation at a. Since node b is tied to ground, $v_b = 0$. We cannot write a node equation at c, we need to use the constraint equation, $v_a = v_b$. Once, we know v_c, we then proceed to solve for $V_{open\ circuit}$ and $I_{short\ circuit}$. This will lead to $V_{Thev}(t) = V_{open\ circuit}$ and $R_{equivalent} = V_{open\ circuit}/I_{short\ circuit}$.

$$[(v_a - 7.5)/10k] + [(v_a - v_c)/10k] + 0 = 0$$

Our constraint equation leads to,

$$v_a = v_b = 0 \text{ or } v_c = -7.5 \text{ volts}$$

This is also the open circuit voltage (note, the op-amp keeps the output voltage at –5 volts in spite of any connection between A and B. Since this means that even a short from A to B would theoretically then produce an infinite current, $R_{equivalent} = 0$. In real life, the short circuit current will be limited to whatever the op-amp can put out into a short circuited output.

V_{Thev} = **–7.5 volts**; $R_{equivalent}$ = **0-ohms**.