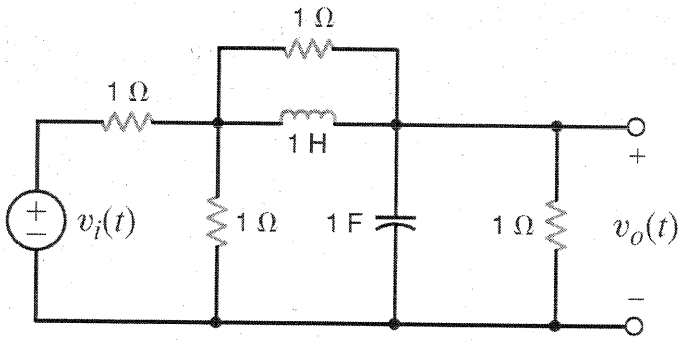
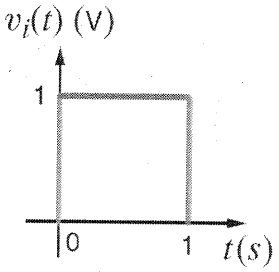
14.43 Determine the output voltage, $v_o(t)$, in the circuit in Fig. P14.43a if the input is given by the source described in Fig. P14.43b.



(a)

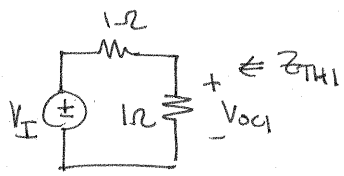


(b)

Figure P14.43

SOLUTION: $v_i(t) = u(t) - u(t-1) \Rightarrow V_I(s) = \frac{1}{s}(1 - e^{-s})$ V

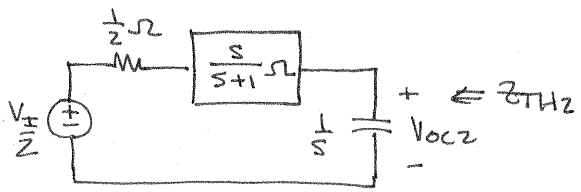
Use Thevenins twice!



$V_{oc1} = \frac{V_I}{2}$

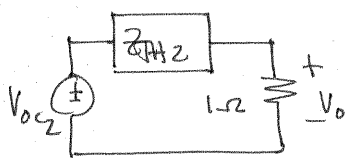
$Z_{TH1} = \frac{1}{2}\,\Omega$

$\Rightarrow$



$$V_{oc2} = \frac{V_I}{2}\left[\frac{1/s}{\frac{1}{2} + \frac{s}{s+1} + \frac{1}{s}}\right] = \frac{V_I(s+1)}{3s^2+3s+2}$$

$$Z_{TH2} = \frac{\frac{1}{s}\left(\frac{1}{2} + \frac{s}{s+1}\right)}{\frac{1}{2} + \frac{1}{s} + \frac{s}{s+1}}$$



$$V_o = V_{oc2}\left(\frac{1}{1+Z_{TH2}}\right)$$

$$Z_{TH2} = \frac{3s+1}{3s^2+3s+2}$$

$$V_o = \frac{(1/3)}{s(s+1)}\,(1-e^{-s}) = \left(\frac{1/3}{s} - \frac{1/3}{s+1}\right)(1-e^{-s})$$

$$v_o(t) = \tfrac{1}{3}\left[1-e^{-t}\right]u(t) - \tfrac{1}{3}\left[1-e^{-(t-1)}\right]u(t-1)\ V$$ ✓