36. With regard to the circuit depicted in **Fig. 14.44**, the initial voltage across the capacitor is $v(0^-) = 1.5$ V and the current source is $\mathbf{i}_s = 700u(t)$ mA. (*a*) Write the differential equation which arises from KCL, in terms of the nodal voltage $v(t)$. (*b*) Take the Laplace transform of the differential equation. (*c*) Determine the frequency-domain representation of the nodal voltage. (*d*) Solve for the time-domain voltage $v(t)$.

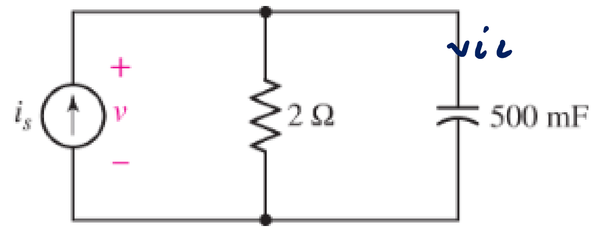

FIGURE 14.44

(a) $i_s(t) = \dfrac{v(t)}{2\Omega} + (500\,\text{mF})\dfrac{dv(t)}{dt}$

(b) $I(s) = \frac{1}{2}V(s) + \frac{1}{2}[sV(s) - v(0^-)]$

$I(s) = \mathcal{L}\{0.7u(t)\} = 0.7\frac{1}{s}$

$v(0^-) = 1.5$

$$\boxed{\frac{0.7}{s} = \frac{1}{2}V(s) + \frac{s}{2}V(s) - \frac{1.5}{2}}$$

(c) $$V(s) = \frac{\left(\frac{0.7}{s} + \frac{1.5}{2}\right)}{\left(\frac{1}{2} + s/2\right)} = \boxed{\frac{1.4 + 1.5s}{s + s^2}}$$

(d) $$\frac{1.4 + 1.5s}{s(s+1)} = \frac{k_1}{s} + \frac{k_2}{s+1}$$

$$\begin{cases} k_1 = \left.\dfrac{1.4 + 1.5s}{s+1}\right|_{s=0} = 1.4 \\ k_2 = \left.\dfrac{1.4 + 1.5s}{s}\right|_{s=-1} = 0.1 \end{cases}$$

$$\mathcal{L}^{-1}\left\{\frac{1.4}{s} + \frac{0.1}{s+1}\right\} = \boxed{1.4u(t) + 0.1e^{-t}u(t)} = v(t)$$