ex01_Q2: LIF Solution

Show that

$$v(t) = v_{in} - (v_{in} - v_0) e^{\frac{t_0 - t}{\tau}}$$

is a solution of

$$\tau \frac{dv}{dt} = v_{in} - v \qquad v(t_0) = v_0$$

Pf: Simply plug the solution in & show that the DE is satisfied.

$$LHS = \tau \frac{dv}{dt}$$

$$= -\tau (v_{in} - v_0) \left(-\frac{1}{\tau}\right) e^{\frac{t_0 - t}{\tau}}$$

$$= (v_{in} - v_0) e^{\frac{t_0 - t}{\tau}}$$

$$RHS = v_{in} - v$$

$$= v_{in} - \left[v_{in} - (v_{in} - v_0) e^{\frac{t_0 - t}{\tau}} \right]$$

$$= (v_{in} - v_0) e^{\frac{t_0 - t}{\tau}}$$

$\therefore$ LHS = RHS, as required ∎