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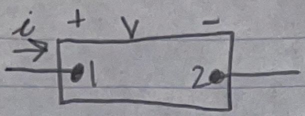
HW #1 ENGR 065

#1



$$i(t) = \begin{cases} 0 & \text{for } t \le 0 \\ 125e^{-2500t}\ mA & \text{for } t \ge 0 \end{cases}$$

a) Find the expressions; $q(t)$; the charge accumilating at the upper terminal, for $t \ge 0$.

$$i(t) = dq/dt \qquad i(t) = 125e^{-2500t}\ mA$$

$$q(t) = \int_0^t i(t)dt \qquad \text{when } t \ge 0$$

$$\Downarrow$$

$$q(t) = \int_0^t 125e^{-2500t}\ mA \cdot dt \Rightarrow q(t) \int_0^t 125e^{-2500t} \cdot 10^{-3} dt$$

$$= \left[\frac{125e^{-2500t} \cdot 10^{-3}}{-2500}\right]_0^t \Rightarrow \frac{125 \cdot 10^{-3}(e^{-2500t} - e^{-2500(0)})}{-2.5 \cdot 10^3}$$

$$\boxed{= 50 \cdot 10^{-6}(1 - e^{-2500t})\ (\text{for } t > 0)}$$

b) Find the charge that has accumulated as $t \to \infty$

$t \to \infty$

$$\lim_{t\to\infty} (50 \cdot 10^{-6}(1 - e^{-2500t}))$$

$$50 \cdot 10^{-6}(1 - \lim_{t\to\infty}(e^0) \cdot \lim_{t\to\infty}(e^{-2500t}))$$

$$50 \cdot 10^{-6}(1 - 0)$$

$$50 \cdot 10^{-6}(1) \boxed{= 50 \cdot 10^{-6}\ C \ /\ 50\ \mu C}$$