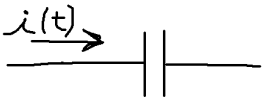
Example- A capacitor has a current $i(t)$ applied starting at time $t = 0$. How much charge is added after 10 s? If the capacitor is initially storing -6 mC of charge, how much total charge is it storing at $t =$ 10 s?

$$i(t) = \begin{cases} 0 & t < 0 \\ 2e^{-t/4}\ mA & t \geq 0 \end{cases}$$



$$\Delta q = \int_{t_0}^{t} i\,dt = \int_{t=0}^{10} 2\times10^{-3} e^{-t/4}\,dt \qquad (1.2)$$

$$= 2\times10^{-3}\,\frac{e^{-t/4}}{(-1/4)}\Bigg|_{t=0}^{10} = -8\times10^{-3}\left[e^{-10/4} - e^{0}\right]$$

$$= 7.3433\times10^{-3}\ C$$

$$\underline{\Delta q = 7.3433\ mC}$$

$$q_{tot}(10s) = \int_{t_0}^{t} i\,dt + q(t_0) = \int_{t=0}^{10} 2\times10^{-3} e^{-t/4}\,dt + q(0)$$

$q(0) \rightarrow -6\ mC$

$$= 7.3433 - 6\ mC$$

$$\underline{q_{tot}(10s) = 1.3433\ mC}$$