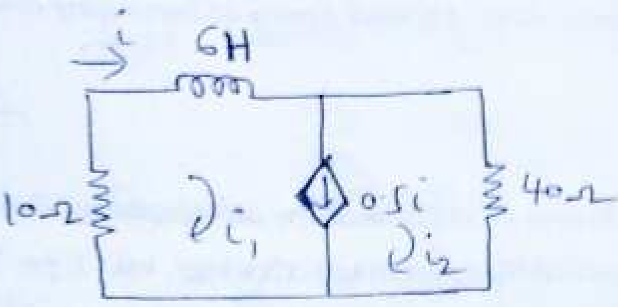
Answer

7.19

Given Circuit ①



Let us form two loops. By representing two loop Currents as shown above

From the Circuit $i_1 = i$ —①

∴ The dependent source of value $0.5i$ is removed interms of i_1 & i_2 as to

form Super-Mesh, $i_1 - i_2 = 0.5i$

$$i_1 - i_2 = 0.5 i_1 \quad [\because i_1 = i$$

$$i_2 = 0.5 i_1 \quad \text{—②}$$

A Super-mesh equation is

$$10 i_1 + 6 \frac{di_1}{dt} + 40 i_2 = 0$$

But $i_1 = i$

$$10i + 6 \frac{di}{dt} + 40(0.5 i_1) = 0 \quad [\because \text{from eq—②}$$

$$10i + 6 \frac{di}{dt} + 40(0.5 i) = 0 \quad [\because \text{from eq—①}$$

$$6 \frac{di}{dt} + 10i + 20i = 0$$

$$6 \frac{di}{dt} + 30i = 0$$

$$\frac{di}{dt} + 5i = 0 \quad \text{—③}$$

$\frac{}{dt} + 3c = 0$ (3)

2

Comparing the above equation with general first order non-linear differential equation i.e, $\frac{dy}{dt} + py = q$ whose solution consists of two parts as

$$y = ce^{-pt} + e^{-pt} \int q e^{pt} dt$$

Comparing the above eq to get the solution for the equation — (3) we will get

$$i(t) = ce^{-5t} + e^{-5t} \int 0 e^{5t} dt$$

$$\boxed{i(t) = ce^{-5t}} A$$

The arbitary constant c in the above solution can be obtained by applying initial condition at $t=0^+$

At $t=0^+$, $i(0^+) = 5A$ [Given in the problem]

$$\therefore \quad i(0^+) = ce^{0}$$

$$5 = c(1)$$

$$\Rightarrow c = 5$$

$$\therefore \quad \boxed{i(t) = 5e^{5t}} A$$

Likes: 1 **Dislikes: 0**