Saturday, March 26, 2022
3:15 PM

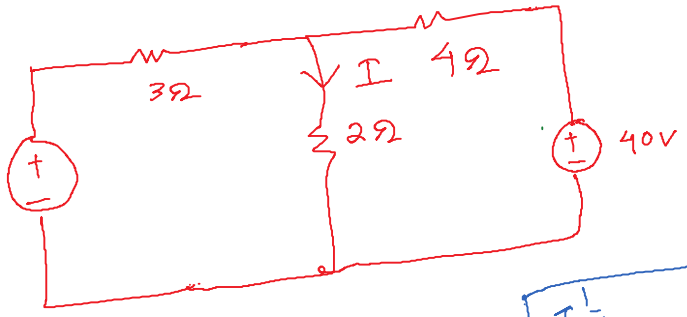
Superposition Theorem

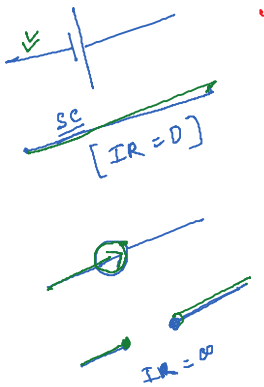
→ linear n/w
→ n/w containing independent source

In a linear bilateral n/w, containing independent source, the resultant current / voltage of any branch is a no of the algebric sum of current / voltage one source at a time by taking all other sources by their internal deactivating resistance.

Ex : 1

Find I through 2Ω using superposition theorm

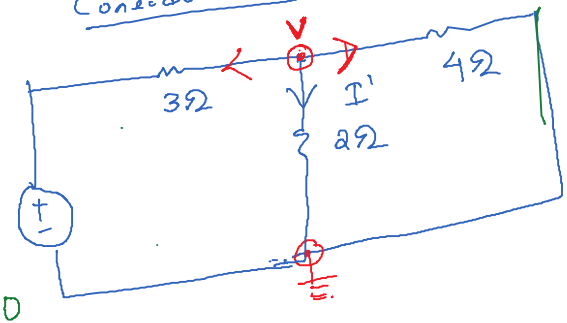




$I' =$

Consider 35V

Step I



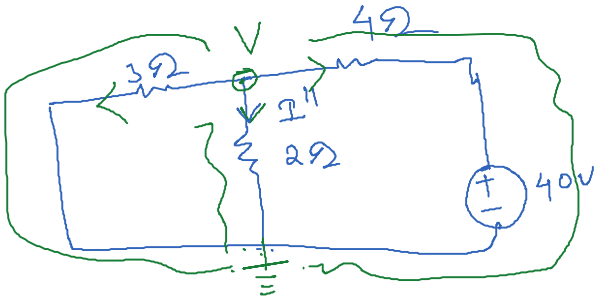
$$\frac{V-35}{3} + \frac{V}{2} + \frac{V}{4} = 0$$

$$\Rightarrow \frac{4V - 140 + 6V + 3V}{12} = 0$$

$$\Rightarrow V = \frac{140}{13}\ V$$

$$I' = \frac{V}{2} = \frac{70}{13}\ A$$

Step II



$$I = I' + I''$$

$$\Rightarrow \frac{V}{3} + \frac{V}{2} + \frac{V-40}{4} = 0$$

$$\Rightarrow \frac{4V + 6V + 3V - 120}{12} = 0$$

$$I = \frac{70}{13} + \frac{60}{13}$$

$$= 10A$$

$$I'' = \frac{V}{2} = \frac{60}{13}\ amp$$

$= 10A$

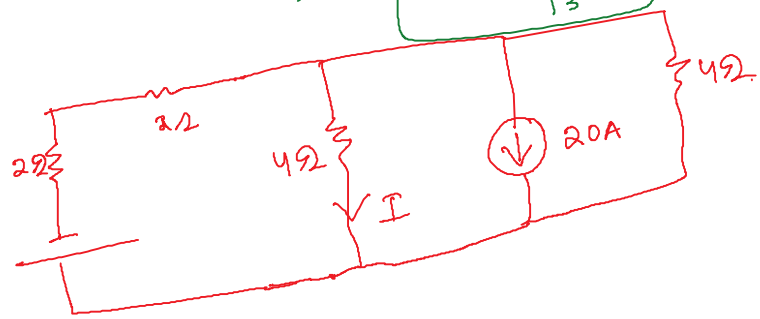
$I'' = \frac{V}{2} = \frac{60}{13}$ amp

$\Rightarrow \quad 12$

$\Rightarrow \quad V = \frac{120}{13}$ V

Ex:- 2

Find $I_{4\Omega}$ using superposition theorm.

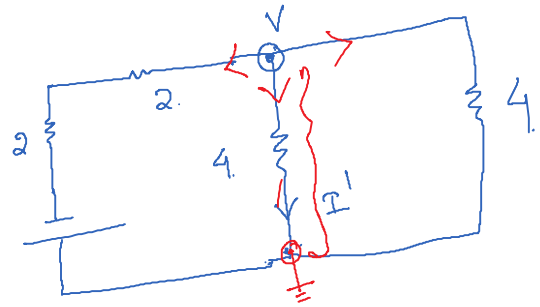


step 1

$\frac{V+10}{4} + \frac{V}{4} + \frac{V}{4} = 0$

$\frac{3V + 10}{4} = 0$

$V = \frac{-10}{3}$ V



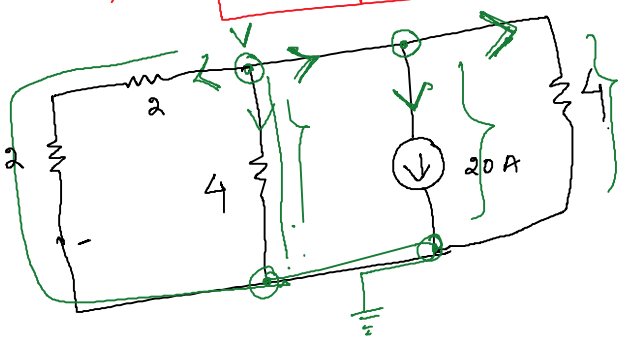
$I' = \frac{V}{4} = \frac{-10}{12} = \frac{-5}{6}$ A

step II

$\Rightarrow \frac{V}{4} + \frac{V}{4} + 20 + \frac{V}{4} = 0$

$\Rightarrow \frac{V + V + 80 + V}{4} = 0$

$\Rightarrow \quad V = \frac{-80}{3}$ V

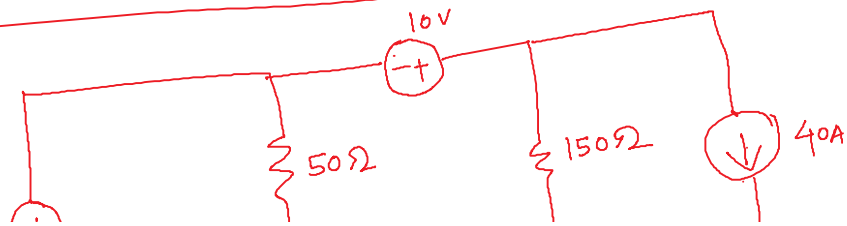


$I'' = \frac{V}{4} = \frac{-80}{12}$

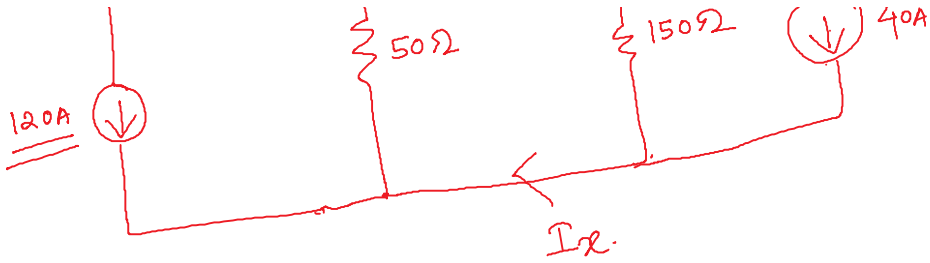
$= \frac{-20}{3}$ A

$I = I' + I'' = -\frac{5}{6} - \frac{20}{3} = -7.5A$

Ex:- 3



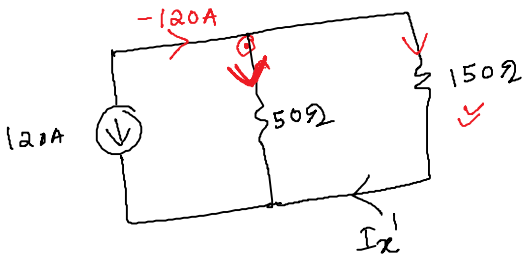
Ex:-2



$I_x' = ?$

Consider 120A

step 1

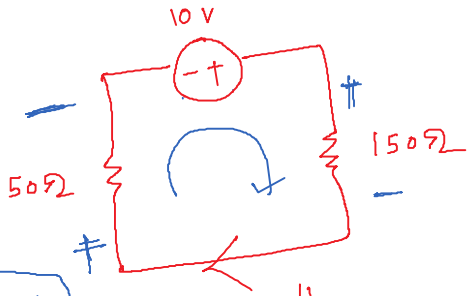


$$I_x' = -120 \times \frac{50}{50+150}$$

$$= -120 \times \frac{50}{200}$$

$$I_x' = -30A$$

step II



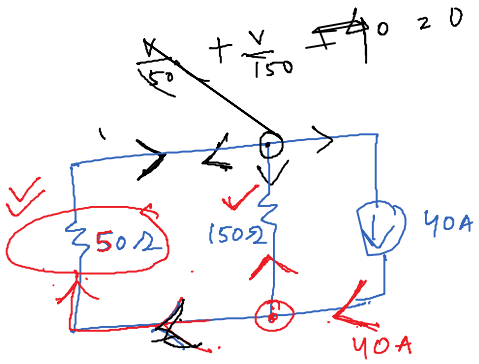
$$10 - 150 I_x'' - 50 I_x'' = 0$$

$$I_x'' = \frac{10}{200} = 0.05A$$

$$I_{R2} = I \times \frac{R1}{R1+R2}$$

$$I_{R1} = I \times \frac{R2}{R1+R2}$$

step III



$$I_x''' = 40 \times \frac{150}{150+50}$$

$$= 40 \times \frac{150}{200}$$

$$= 30A$$

$$V = V' + V'' + V'''$$

$$I = I_x' + I_x'' + I_x'''$$

$$= -30 + 0.05 + 30 = 0.05A$$

HW