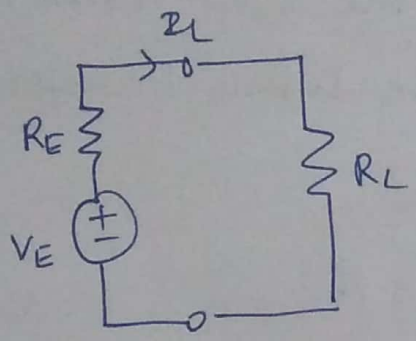
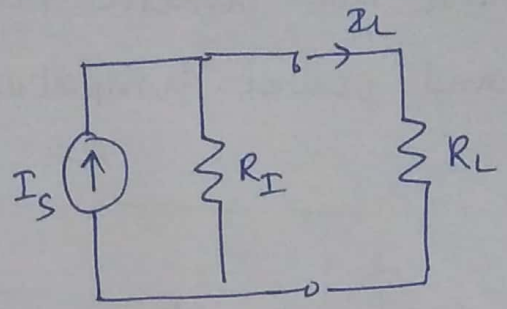
SOURCE TRANSFORMATION



$$I_L = \frac{V_E}{R_E + R_L}$$



$$I_L = I_S \cdot \frac{R_I}{R_I + R_L}$$

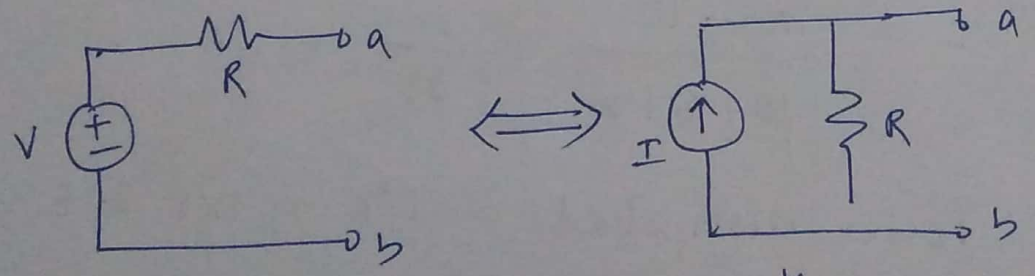
For the above two circuits to be the same,

I_L should be equal.

$$\therefore \frac{V_E}{R_E + R_L} = \frac{I_S R_L}{R_I + R_L}$$

This shows, $V_E = I_S R_L$, $R_E = R_I$ } For the equivalence.

Hence we use this to do some transformation - to simplify circuits.



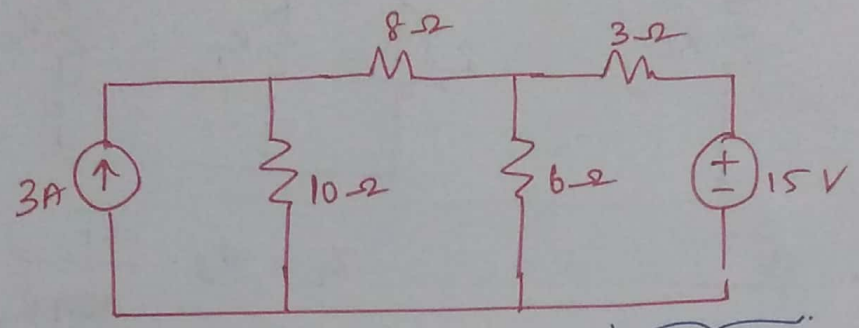
$V = IR$.

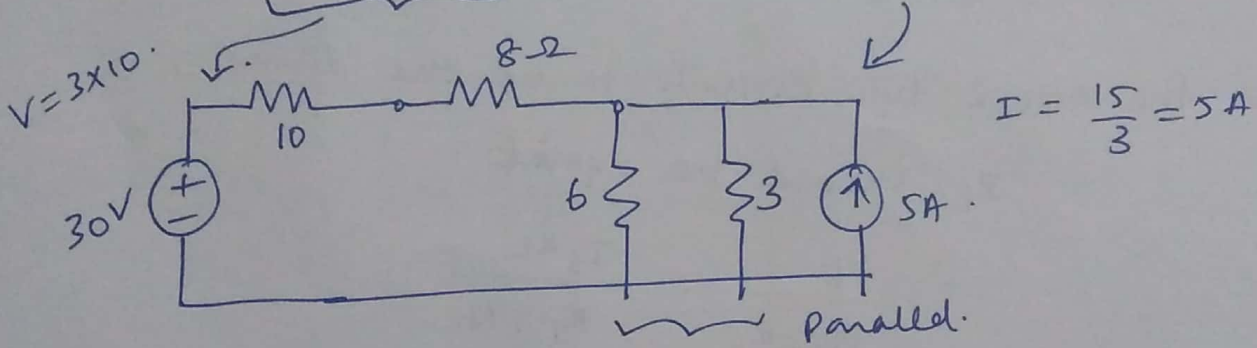
Voltage source in series with R $\Longleftrightarrow$ Current source in parallel with R.

$$I = \frac{V}{R}$$

Example:

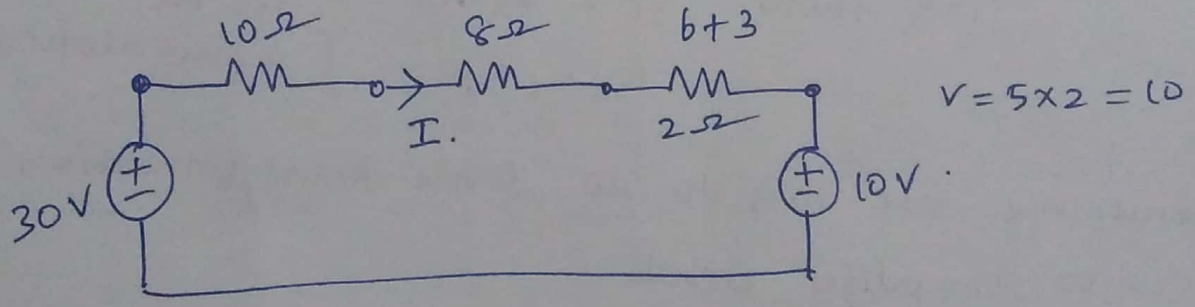
① Find the current through the 8Ω resistor and power dissipated, use source transformation.





$I = \frac{15}{3} = 5A$

$R = \frac{6 \times 3}{6+3} = 2\Omega.$

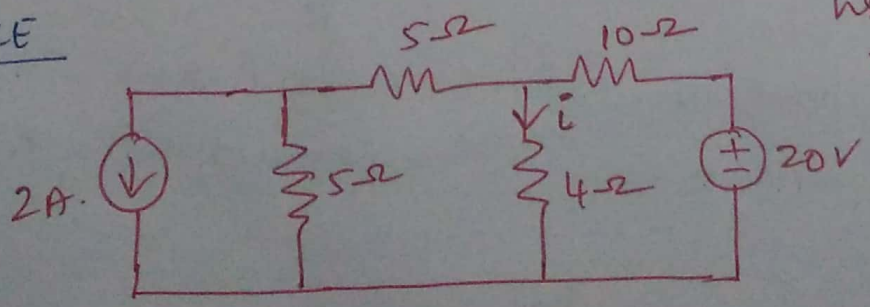


$V = 5 \times 2 = 10$

$$I = \frac{30 - 10}{10 + 8 + 2} = \frac{20}{20} = 1A.$$

Power dissipated $= I^2R = 1 \times 8 = 8W.$

PRACTICE

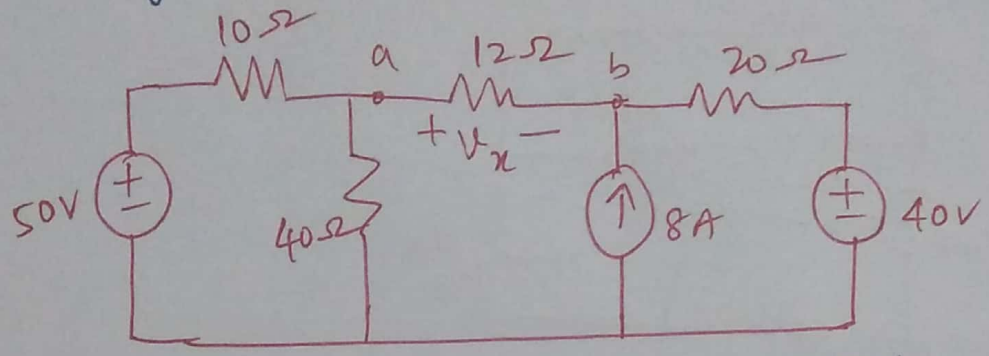


using source transformation find i.

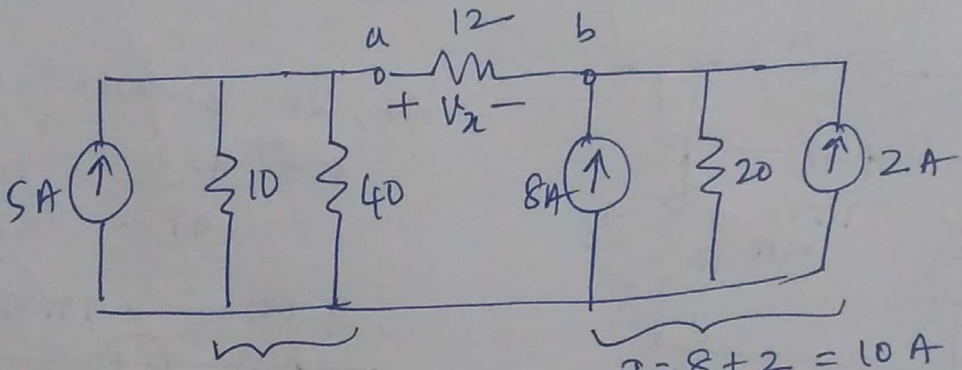
Ans

$i = 0.555A$

(3) Using source transformation find V_x.

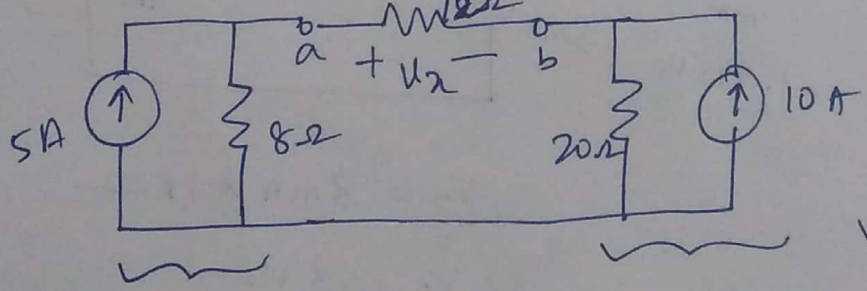


$I = \frac{50}{10}$ ↙ ⇓ $I = \frac{40}{20}$



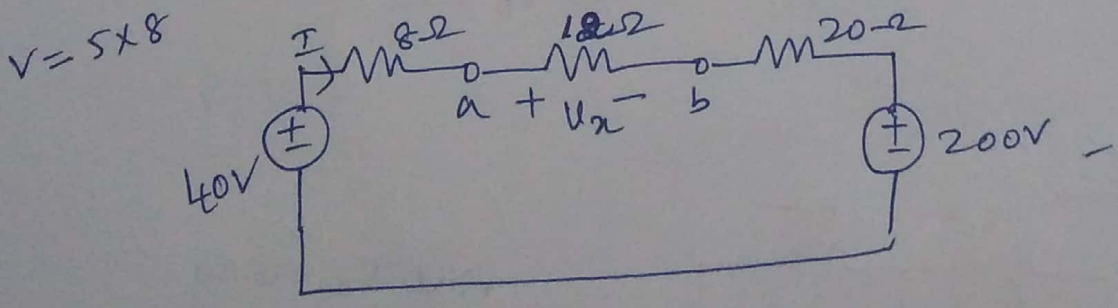
$I = 8 + 2 = 10\,A$.

$\frac{10 \times 40}{10+40} = 8\,\Omega$



$V = I \times R = 10 \times 20$

$V = 5 \times 8$

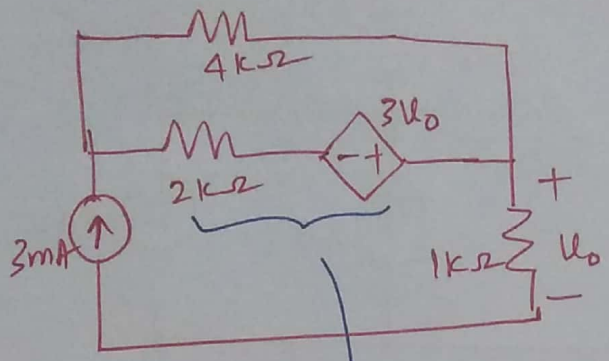


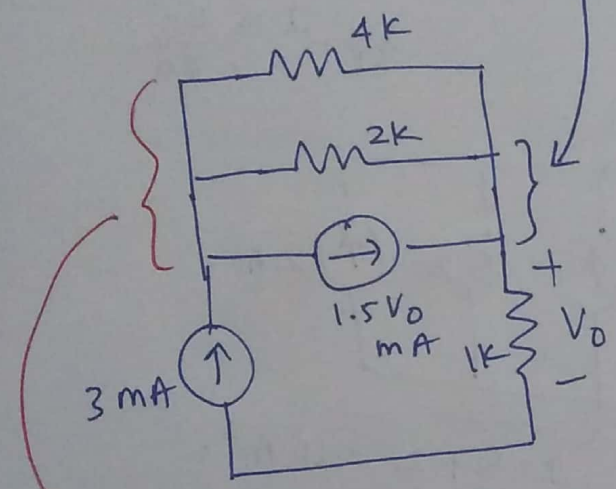
$V_x = I \times 8\Omega$ $\qquad I = \frac{40 - 200}{8 + 12 + 20} = -4\,A$

$V_x = -4 \times 12$

$\boxed{V_x = -48\,V}$

(2) Find V_o using source transformation

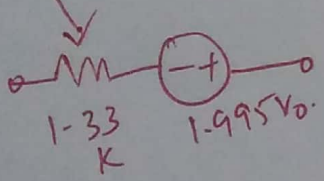




$$I = \frac{3V_o}{2k\Omega} = 1.5V_o \text{ mA}$$

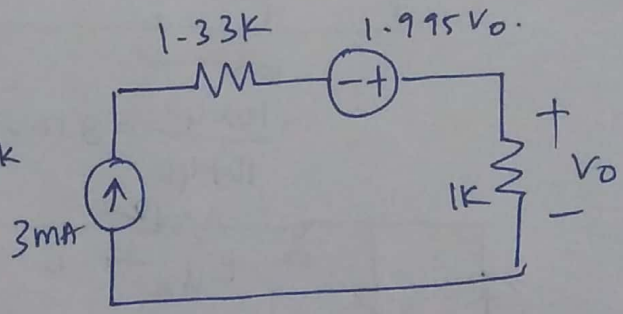
4K, 2K parallel.

$$R = \frac{4 \times 2}{4+2} = 1.33k\Omega$$



$$V = 1.5V_o \text{ mA} \times 1.33k$$

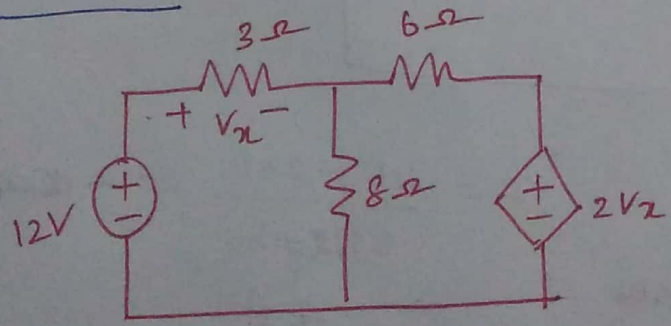
$$= 1.995V_o$$



$$V_o = 3\text{mA} \times 1k\Omega$$

$$V_o = 3\text{ V}.$$

PRACTICE:



Find V_x using source transformation.

Ans: 3.652 V