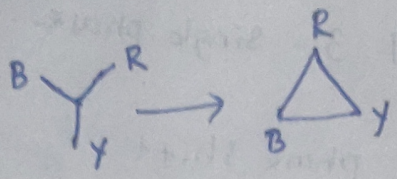
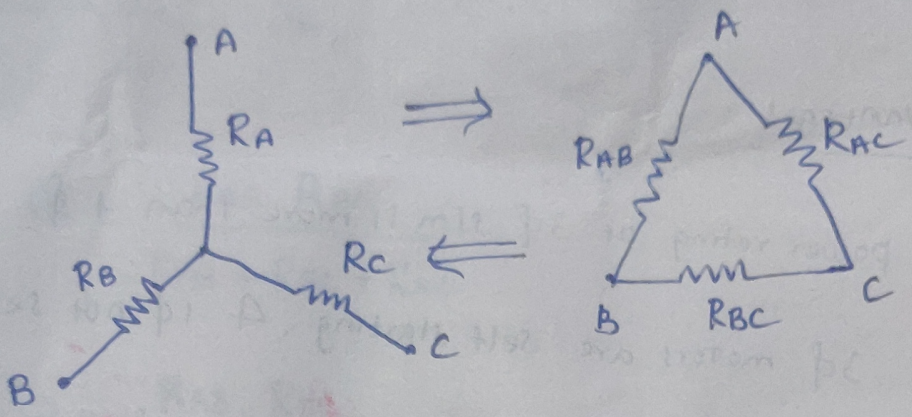
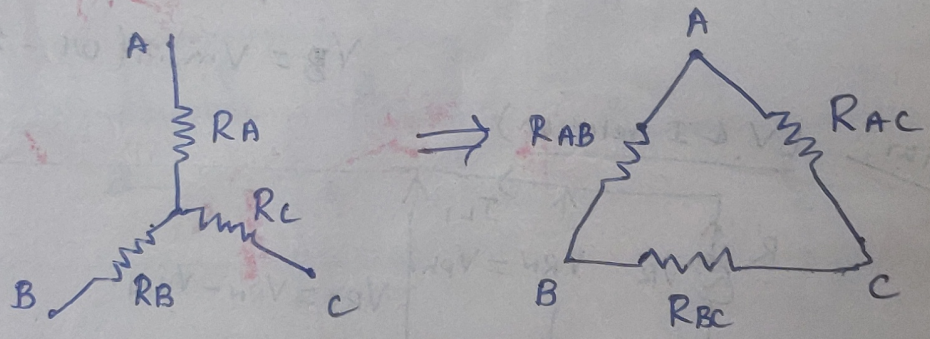
Star- Delta Transformation





→ For Circuit reduction using this Star- Delta transformation.

Star- Delta:-

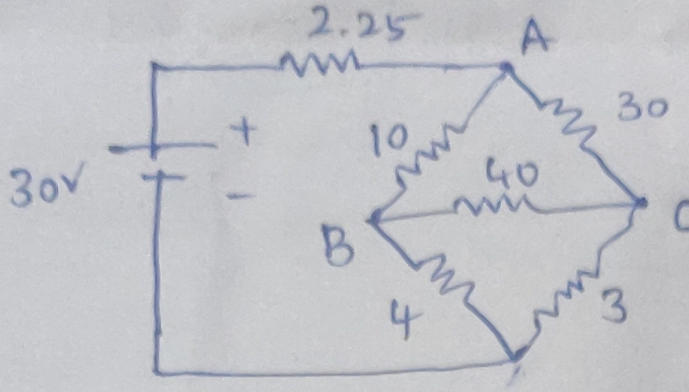


$$R_{AB} = \frac{R_A R_B + R_B R_C + R_A R_C}{R_C}$$

$$R_{AC} = \frac{R_A R_B + R_B R_C + R_A R_C}{R_B}$$

$$R_{BC} = \frac{R_A R_B + R_B R_C + R_A R_C}{R_A}.$$

2) Find the source current for the given circuit.



$\Rightarrow$ $R_{AB} = 10\ \Omega$

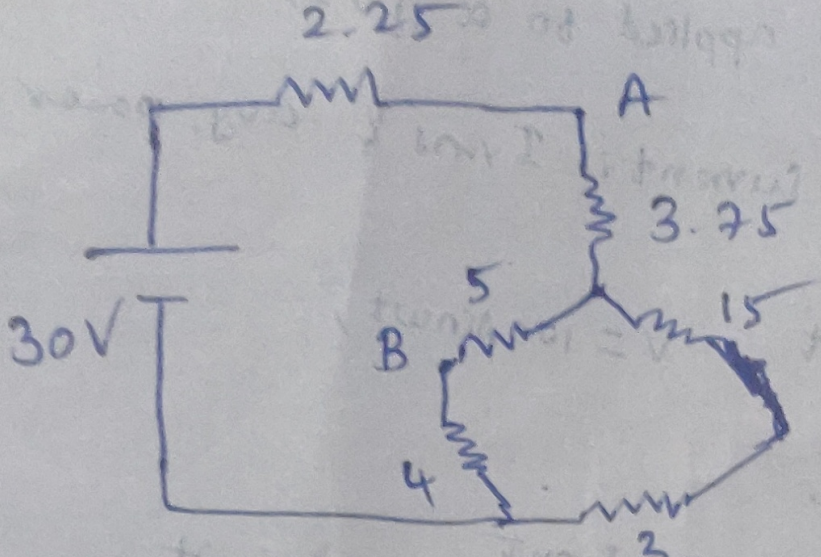
$R_{BC} = 40\ \Omega$

$R_{AC} = 30\ \Omega$

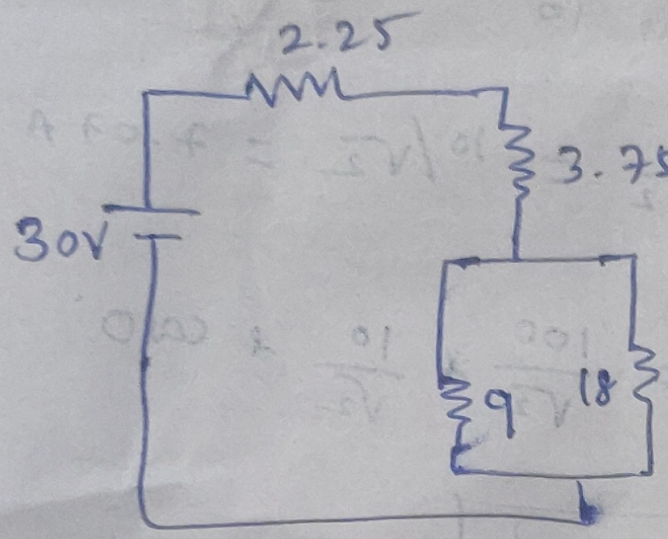
$$R_A = \frac{R_{AB} \cdot R_{AC}}{R_{AB}+R_{BC}+R_{CA}} = \frac{10 \times 30}{10+40+30} = 3.75\ \Omega$$

$$R_B = \frac{R_{BC} \cdot R_{AB}}{R_{AB}+R_{BC}+R_{CA}} = \frac{40 \times 10}{10+40+30} = 5\ \Omega$$

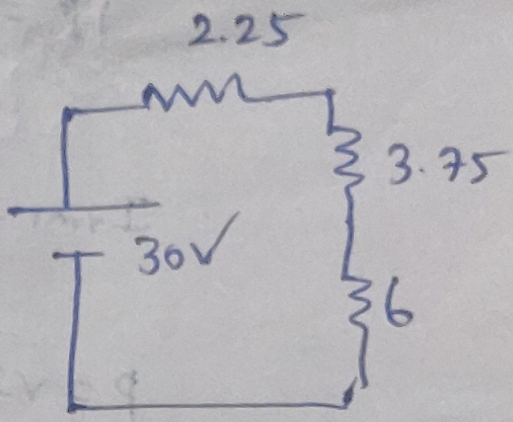
$$R_C = \frac{R_{AC} * R_{BC}}{R_{AB}+R_{BC}+R_{CA}} = \frac{30 * 40}{10+40+30} = 15\ \Omega$$

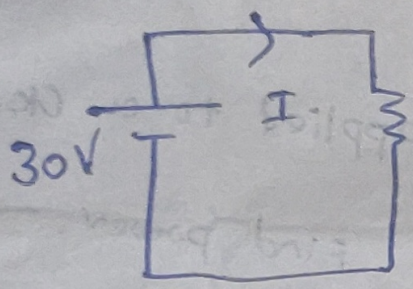


$\Rightarrow (5+4) \,//\, (15+3)$



$\Rightarrow$

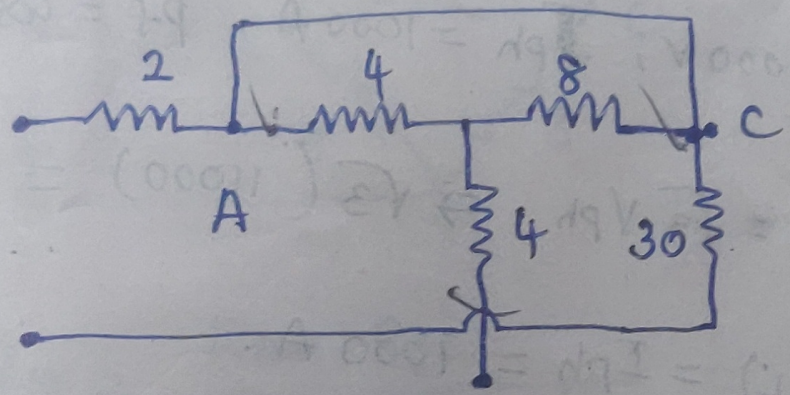


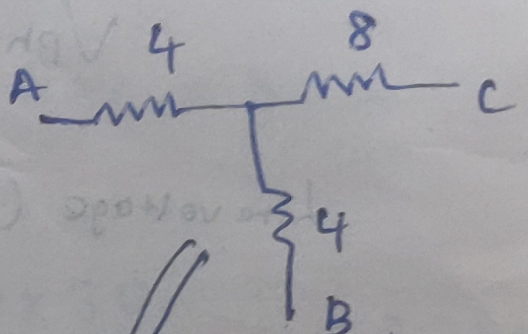


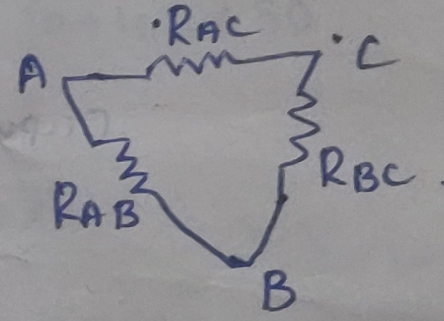
$\Rightarrow I = \frac{V}{R} = \frac{30}{12}$

$$\boxed{I = 2.5\,A}$$

1) Find R-equivalent for given circuit.





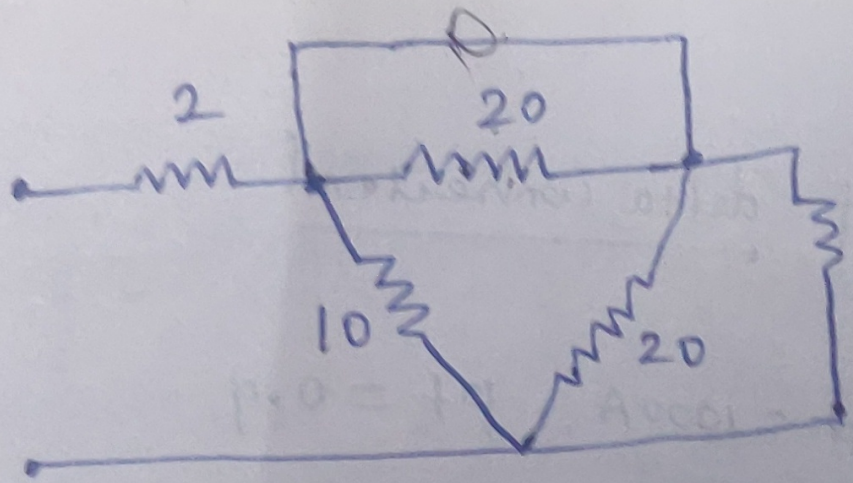


$$R_{AB} = \frac{R_A R_B + R_B R_C + R_A R_C}{R_C}$$

$$= \frac{(4\times4) + (4\times8) + (4\times8)}{8}$$

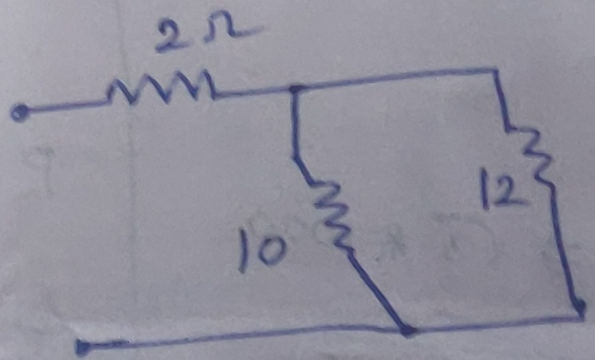
$R_{AB} = 80/8,$ $\boxed{R_{AB} = 10\,\Omega}$

$R_{BC} = 80/4$ $\boxed{= 20\,\Omega.}$, $\boxed{R_{AC} = 20\,\Omega.}$



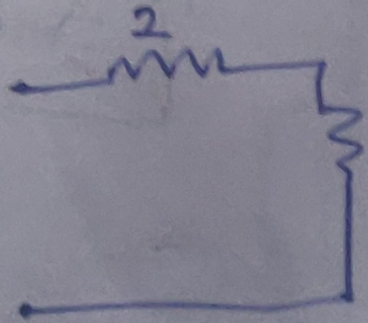
$\Rightarrow 20 \,||\, 30$

$\Rightarrow 12$



$\Rightarrow 10 \,||\, 12$

$\Rightarrow 5.45$



$\Rightarrow 2 + 5.45$

$$\boxed{R_{eq} = 7.45\ \Omega}$$

1) Each phase of a 3ϕ star connected alternator produces a voltage of 11000 V & current of 1000 A at power factor of 0.9. Find the line voltage, line current & total capacity of the alternator.

$V_{ph} = 11000\,V, \quad I_{ph} = 1000\,A, \quad pf = \cos\phi = 0.9$

Line voltage $(V_L) = \sqrt{3} \cdot V_{ph} \Rightarrow \sqrt{3}(11000) = 19052.5\,V$

Line current $(I_L) = I_{ph} = 1000\,A.$

Capacity of power $(P_L) = \sqrt{3}\, V_L I_L \cos\phi$

$= \sqrt{3}\,(19052.5)\,(1000) \times (0.9)$

$\boxed{P_L = 29.7\ MW.}$

1. A voltage $100\sin\omega t$ is applied to a 10-Ω resistor. Find the instantaneous current, I_{rms} & avg. power.

$V = V_m \sin\omega t$, $V = 100\sin\omega t$,

$R = 10\ \Omega$.

$$i = V/R = \frac{100\sin\omega t}{10} = 10\sin\omega t.$$

$$I_{rms} = I_m/\sqrt{2} = 10/\sqrt{2} = 7.07\ A$$

$$P = VI\cos\phi = \frac{100}{\sqrt{2}} * \frac{10}{\sqrt{2}} * \cos 0$$

$$\boxed{P = 500\ W}$$