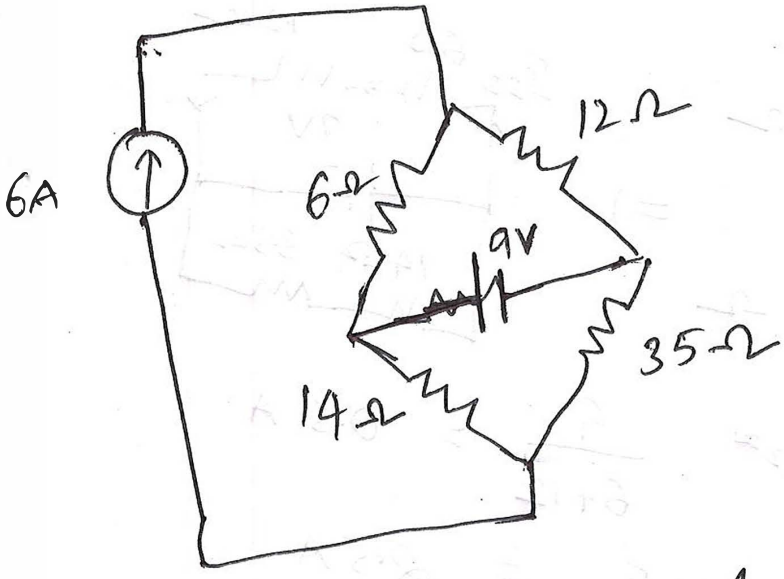
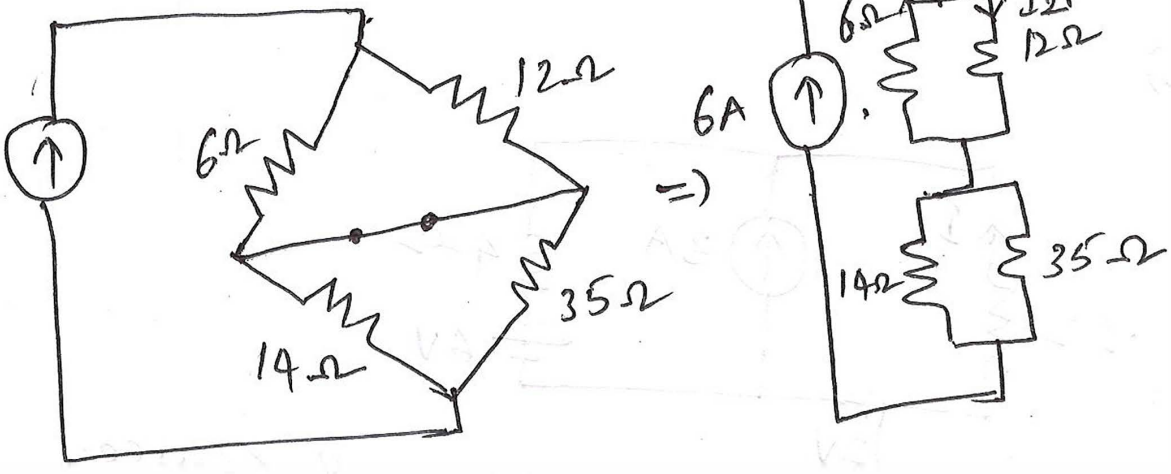
Solutions to Tutorial Sheet-7

1)



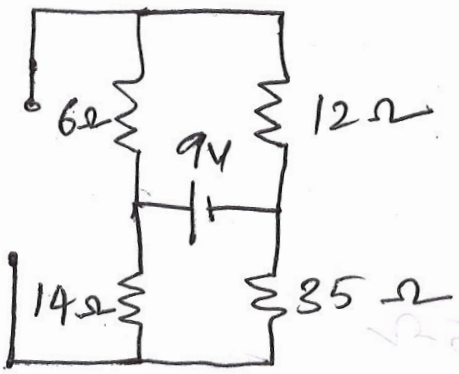
1st Consider the effect of 6A source.



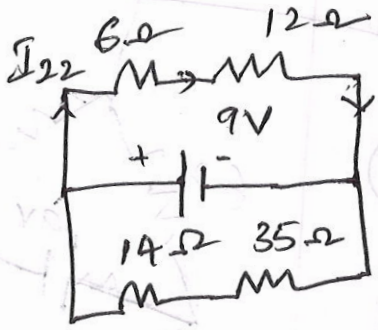
$$I_{21} = \frac{6A \times 6\Omega}{(6\Omega + 12\Omega)} = 2A$$

Consider the effect of 9V source.
Re-drawing the circuit,

P.T.O)



$\Rightarrow$

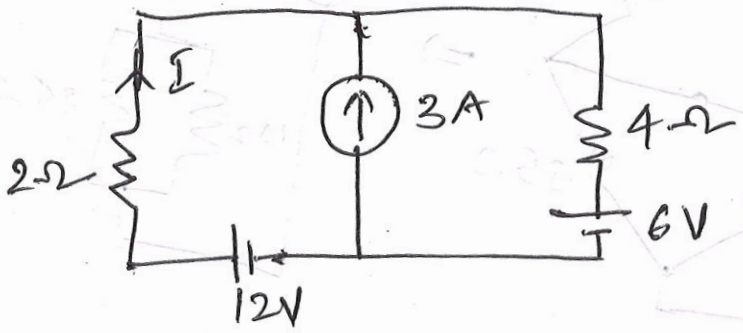


$$I_{22} = \frac{9}{6+12} = 0.5\ A$$

Thus,

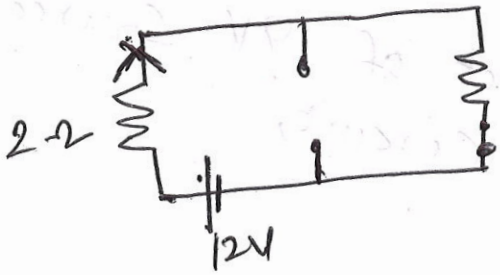
$$I_2 = I_{21} + I_{22} = \underline{\underline{2.5\ A}}$$

2)



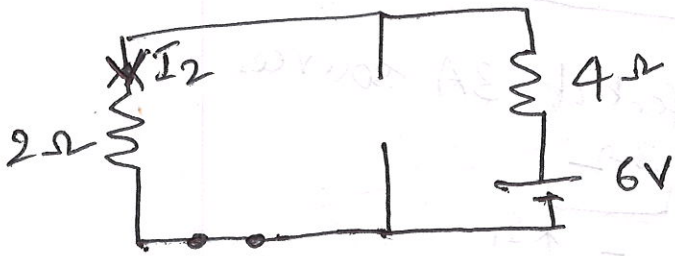
Consider the effect of 12 V source.

Re-drawing the circuit,



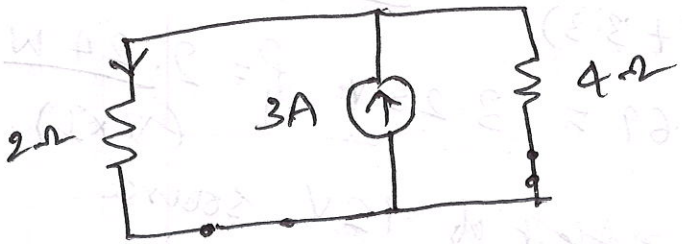
$$I_1 = \frac{12}{2+4} = 2A$$

Consider the effect of 6V source:



$$I_2 = \frac{6}{2+4} = 1A$$

Consider the effect of 3A source



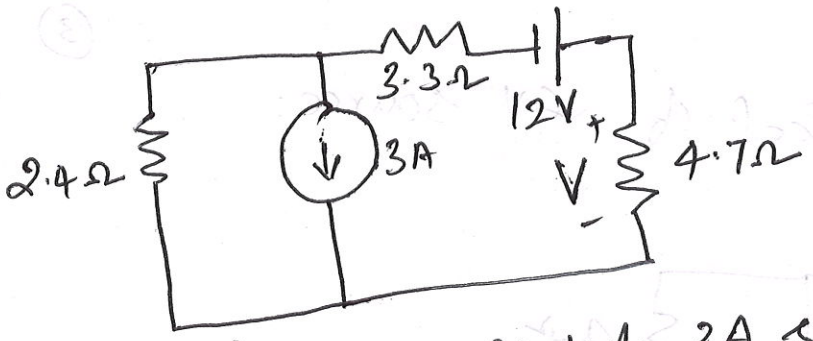
$$I_3 = \frac{3 \times 4}{2+4} = 2A$$

The total current through 2Ω resistor is

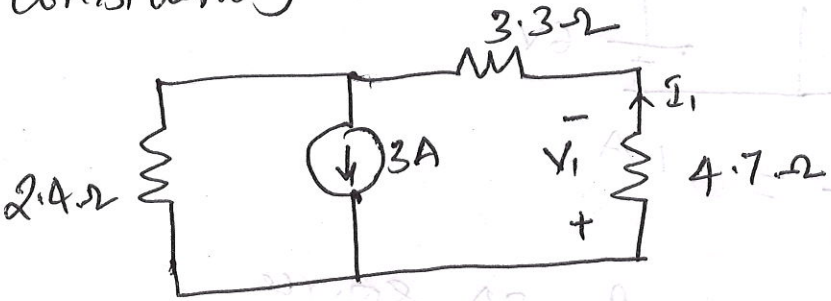
$I = I_1 + I_2 + I_3 = -2 + 1 + 2 = \underline{1A}$

(∵ I_1 is in opposite direction to I_2 and I_3)

3



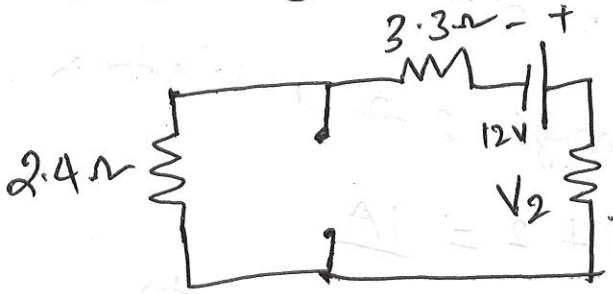
Considering the effect of 3A source.



$$I_1 = \frac{2.4 \times 3A}{2.4 + (4.7 + 3.3)} = 0.69A$$

$V_1 = 4.7 \times 0.69 = 3.25V$ $P_1 = 2.24W$ $(V \times I)$

considering the effect of 12V source



$V_2 = \frac{12 \times 4.7}{4.7 + 2.4 + 3.3}$

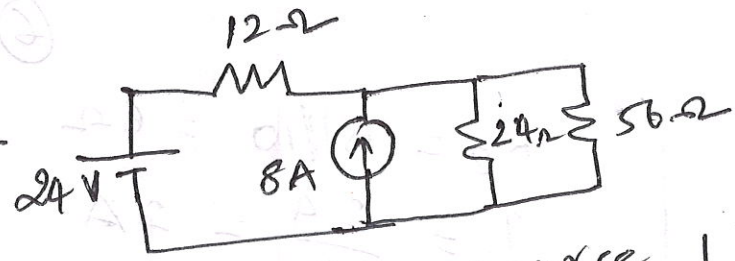
$V_2 = 5.53V$ $P_2 = 6.51W$ (V^2/R)

$V = 5.53 - 3.25 = 2.28V$

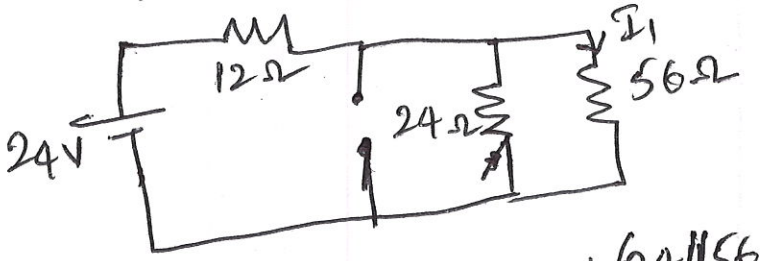
$P = \frac{V^2}{R} = \frac{(2.28)^2}{4.7} = 1.106W$

$P_1 + P_2 \neq P$

4



Considering 24V source



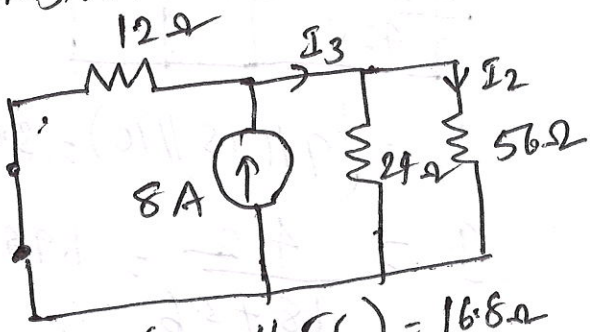
$I_1 = \frac{24V}{R}$ $R = 12 + (24 \| 56)$

$= 28.8\Omega$

$= 0.833\,A$

$I_1 = \frac{0.833 \times 24}{24+56} = 0.25A$

Considering 8A source



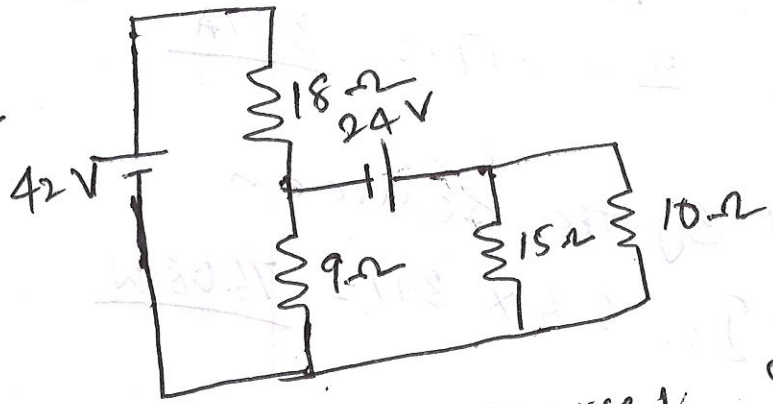
$R_T = (24 \| 56) = 16.8\Omega$

$I_3 = \frac{8 \times 12}{12+16.8} = 3.33A$

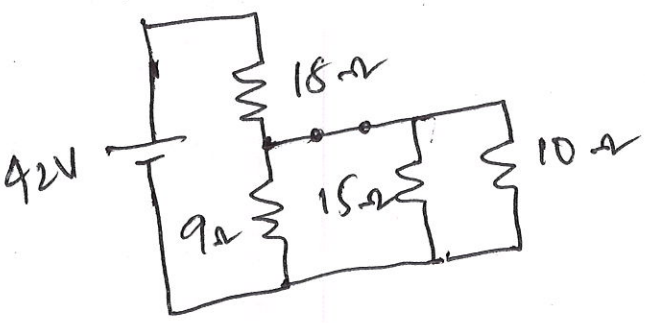
$I_2 = \frac{3.33 \times 24}{24+56} = 1A$

$I = I_1 + I_2 = 0.25 + 1 = \underline{1.25\,A}$

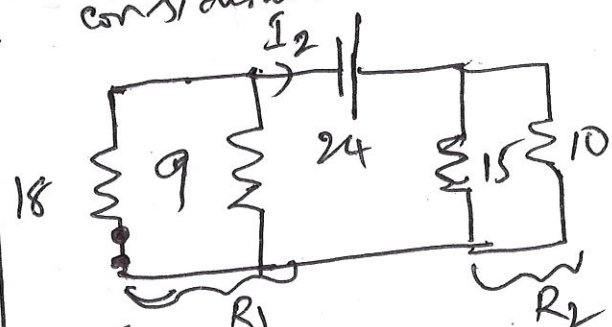
5



Considering 42V source



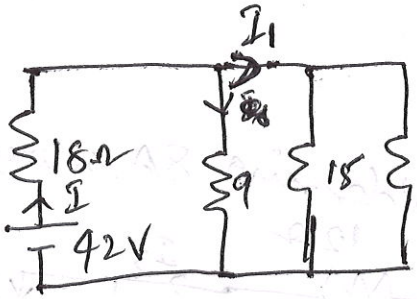
considering 24V source



$I_2 = \frac{24}{R_1 + R_2}$

$R_1 = 18 \| 9 = 6\Omega$

1



$R_1 = (9 \| 15 \| 10) = 3.6\Omega$

$I = \frac{42}{18+3.6} = 1.944A$

$I_1 = \frac{9 \times 1.944}{9\Omega + (15\|10)} = \underline{1.17A}$

(Total current flowing through 18Ω resistor gets divided in to two parts. one part through 9Ω and other through 24V source)

$R_2 = 15 \| 10 = 6\Omega$

$I = \frac{24}{12} = 2A$

$I_2 = I_1 + I_2 = 2 + 1.17 = \underline{3.17A}$

Power delivered by the sources

$P = V \cdot I = 24 \times 3.17 = \underline{76.08\,W}$