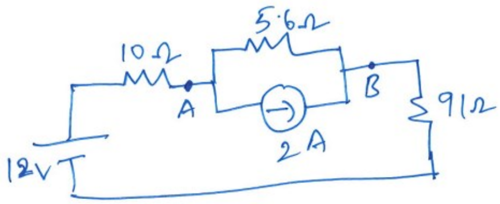
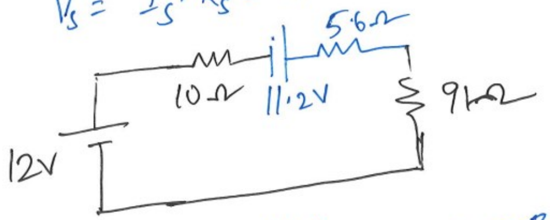
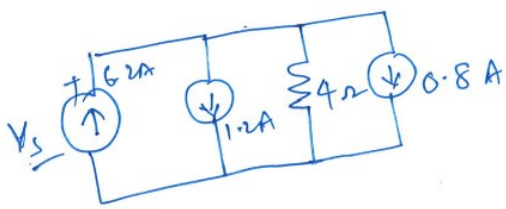
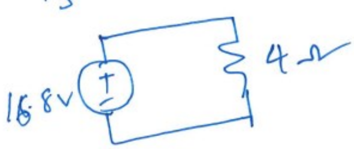
CSET102L

Tutorial Sheet - 4 (Solutions)

SNO	Answers
1	 $V_s = I_s \cdot R_s = 2 \times 5.6 = 11.2\,V$  $I = \dfrac{12 + 11.2}{10 + 5.6 + 91} = \underline{\underline{0.218\,A}}$
2	 $I_{4\Omega} = 6.2 - 1.2 - 0.8A = 4.2A$ $V_s = 4.2 \times 4 = 16.8\,V$ 

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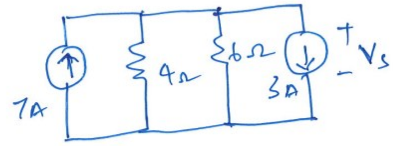
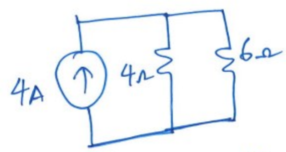
<tr><td>3</td><td>




$I_{4\Omega} = \frac{4 \cdot 6}{4+6} = 2.4A$

$4\Omega \| 6\Omega = 2.4\Omega$

$V_s = 4 \times 2.4 = 9.6V$

9.6 V is voltage across $4\Omega \| 6\Omega$

⇒ 9.6V is voltage across 4Ω and 6Ω and

7 A source and 3A source.

Thus, $V_s = 9.6V$
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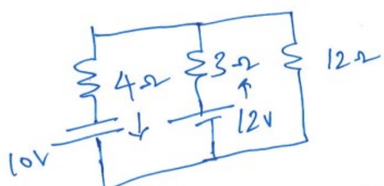
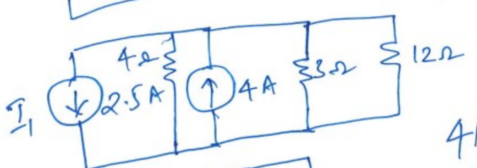
<tr><td>4</td><td>


$10V = I_1 \cdot 4\Omega$

$I_1 = 2.5A$

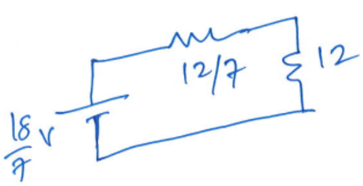
$12V = I \cdot 3\Omega$

$I_2 = 4A$



$4 \| 3 = 12/7\,\Omega$

$1.5 \times \frac{12}{7} = \frac{18}{7}V$



$I = \frac{18/7}{\left(\frac{12}{7}+12\right)} = \frac{3}{16}A$
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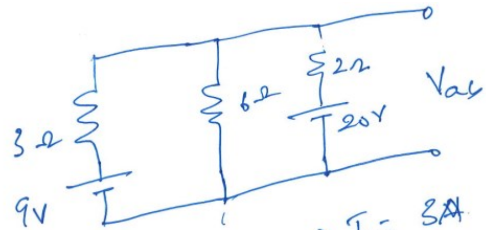
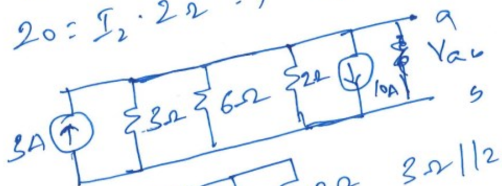
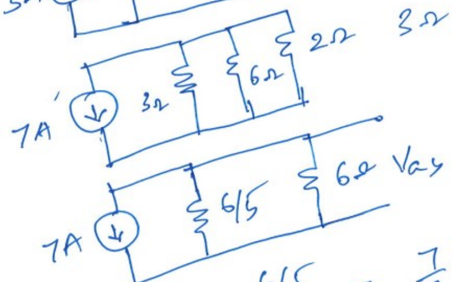


$9 = I_1 \cdot 3\Omega \Rightarrow I_1 = 3A$

$20 = I_2 \cdot 2\Omega \Rightarrow I_2 = 10A$



$3\Omega \| 2\Omega = \frac{6}{5}\Omega$



$I_{6\Omega} = \frac{7 \times 6/5}{(6+6/5)} = \frac{7}{6}A$

$V_{ab} = \underline{\underline{-7V}}$

$V_{6\Omega} = 7V$

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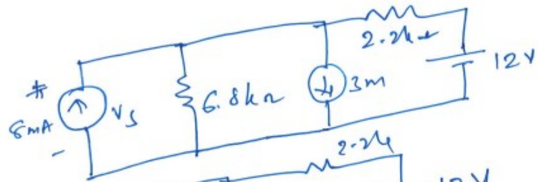
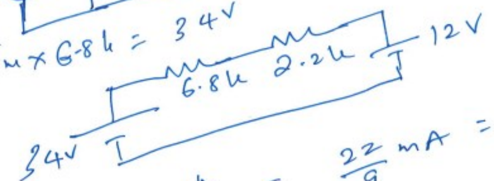
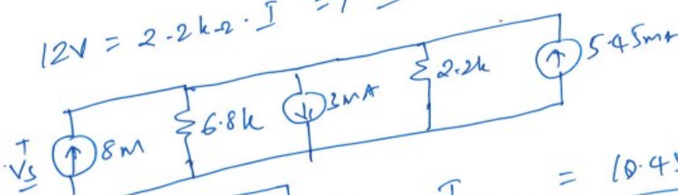


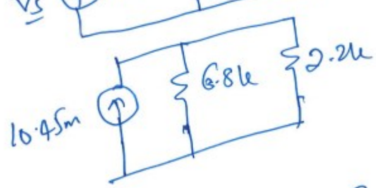
$V = 5m \times 6.8k = 34V$



$$I_{24V} = \frac{34-12}{9k\Omega} = \frac{22}{9} mA = 2.44 mA$$

$$12V = 2.2k\Omega \cdot I \Rightarrow \underline{I} = 5.45 mA$$





$$I_{6.8k\Omega} = \frac{10.45 \times 2.2}{6.8+2.2} = 2.55 mA$$

$$V_{6.8k\Omega} = 6.8k \times 2.55 = \underline{17.35V}$$

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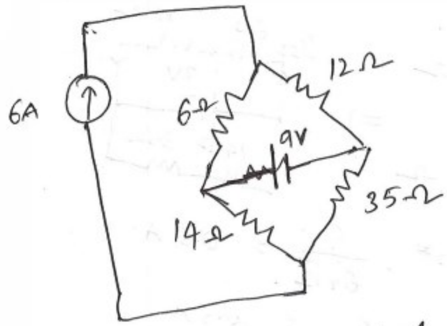
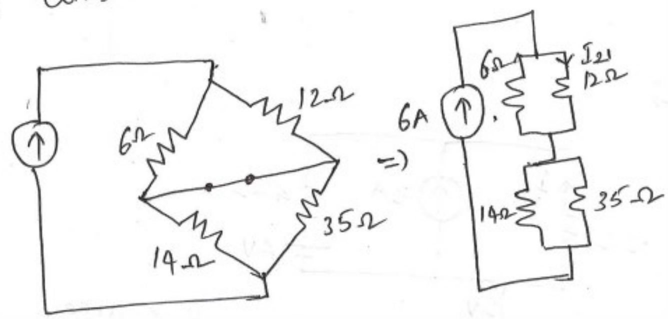
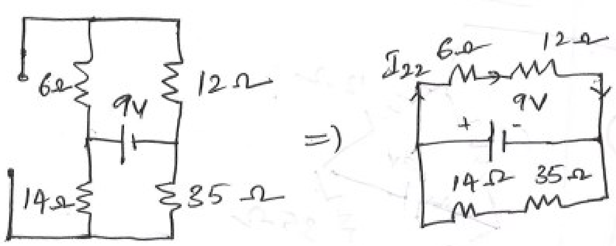


1st Consider the effect of 6A source.



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

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



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

Thus,

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

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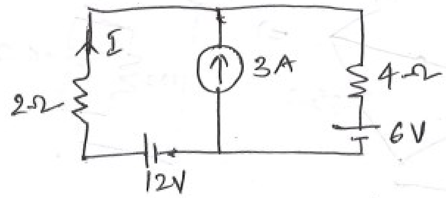
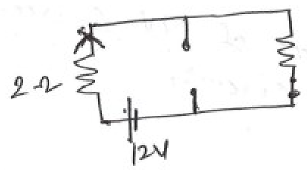


Consider the effect of 12V source.

Re-drawing the circuit,

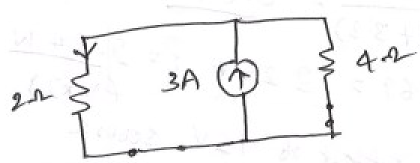


$I_1 = \frac{12}{2+4} = 2A$

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

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

($\because$ I_1 is in opposite direction to I_2 and I_3)

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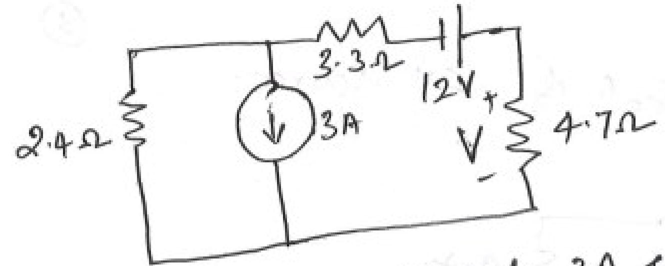
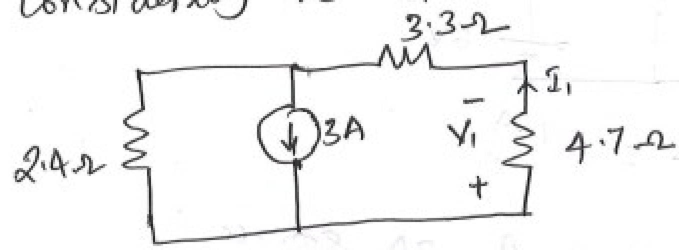


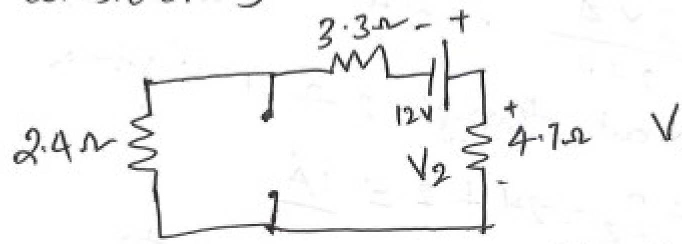
Considering the effect of 3A source.



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

$$V_1 = 4.7 \times 0.69 = 3.25V \quad P_1 = \underline{2.24W} \ (V \times I)$$

Considering the effect of 12V source



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

$$V_2 = \underline{5.53V} \quad P_2 = 6.51W \ (V^2/R)$$

$$V = 5.53 - 3.25 = \underline{2.28V}$$

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

$$\underline{P_1 + P_2 \neq P}$$

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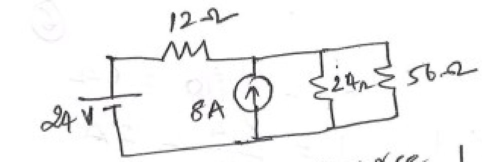
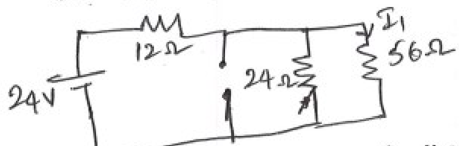


Considering 24V source

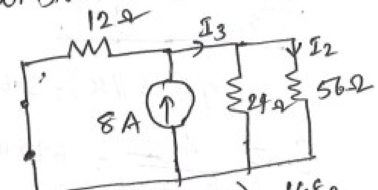


$I = \frac{24V}{R}$ $\quad R = 12 + (24 \| 56) = 28.8\,\Omega$

$= 0.833\,A$

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

Considering 8A source



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

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

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

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

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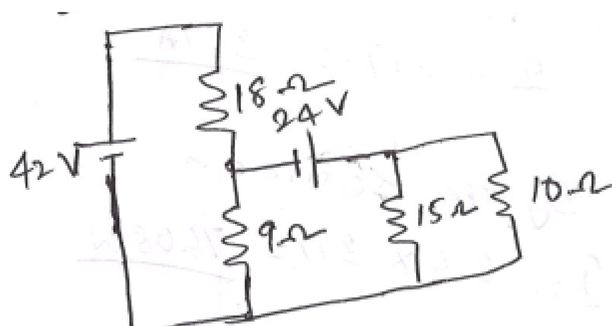
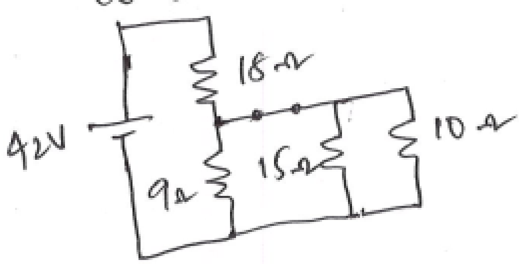
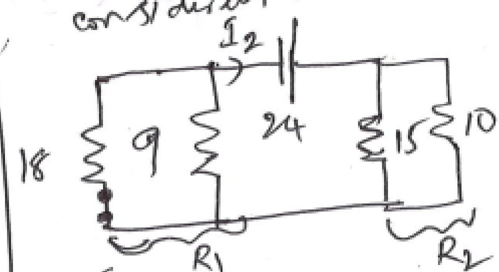


Considering 42 V source

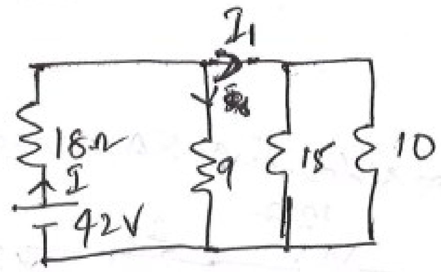


Considering 24V source



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

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



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

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

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

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

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

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

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

Power delivered by the source is

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