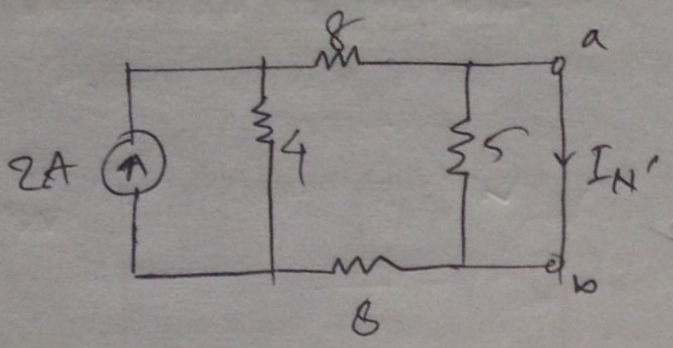
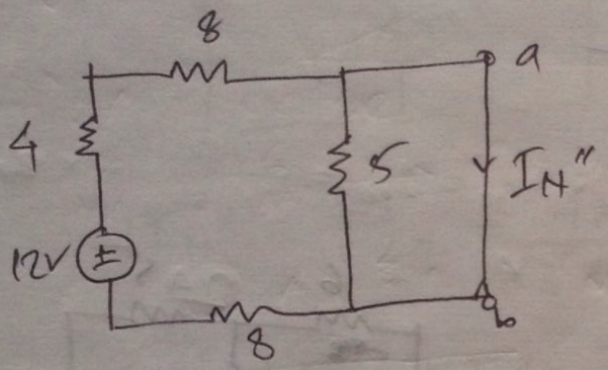
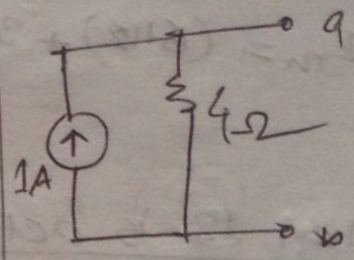


Current won't flow through 5Ω.

$$\downarrow I_N' = \frac{4 \times 2}{8+8+4} = 0.4A$$

when 12V is active





Current won't flow through 5Ω

$$R_{eq} = 4+8+8 = 20\Omega$$

$$\therefore I = \frac{V}{R_{eq}} = \frac{12}{20} = 0.6A$$

$$\therefore \downarrow I_N'' = I = 0.6A$$

$$\therefore I_H = \downarrow I_H' + \downarrow I_H''$$

$$= 0.4 + 0.6 = 1A$$

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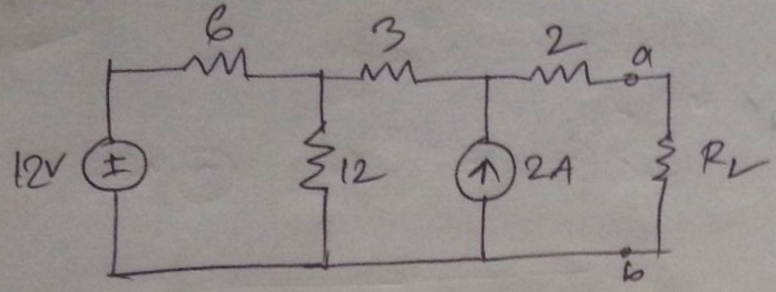
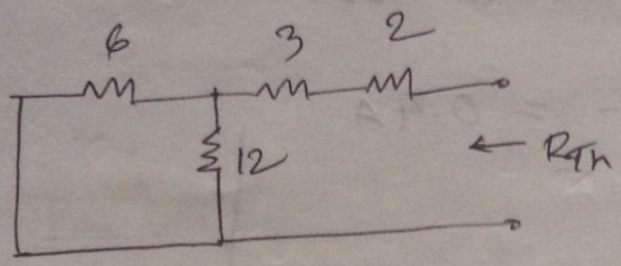
Ex-4.13



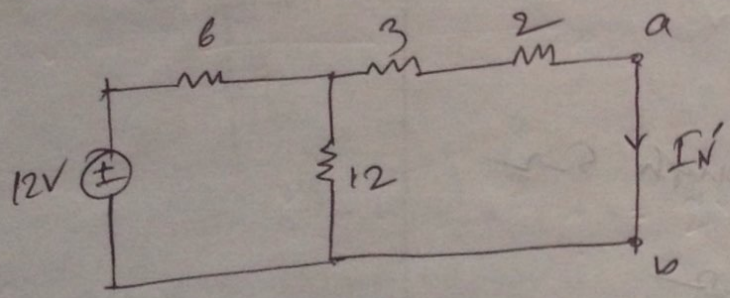
R_{Th}



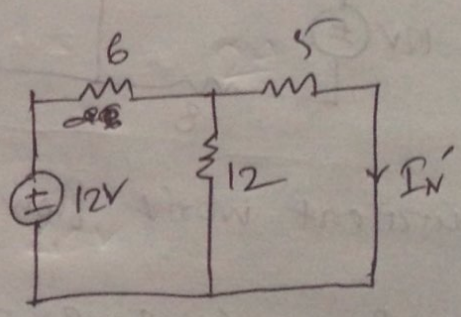
$R_{Th} = (6 \| 12) + 3 + 2 = 9\,\Omega$

V_{Th}

When 12 is active.



$\Rightarrow$



$R_{eq} = (5 \| 12) + 6$

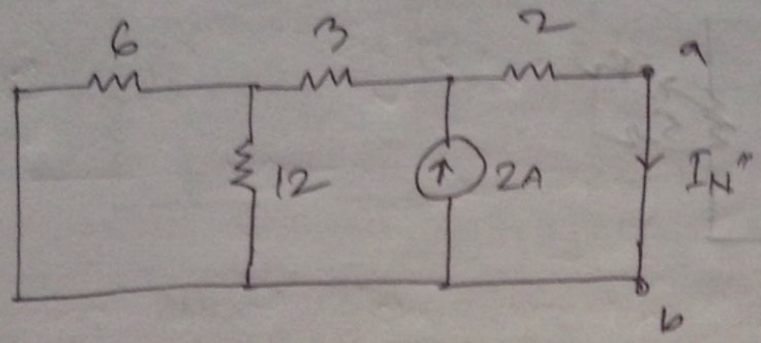
$= 9.53\,\Omega$ $\left(\frac{162}{17}\right)$

$\therefore I = \frac{V}{R_{eq}} = \frac{12}{9.53}$

$= 1.26\,A$ $\left(\frac{34}{27}\right)$

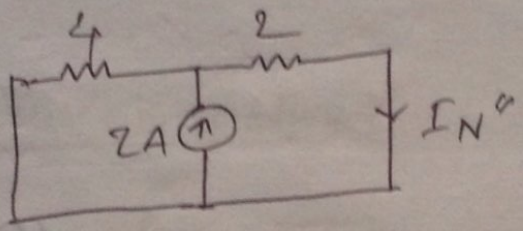
$\therefore I_N' = I_{5\Omega} = \frac{12 \times 1.26}{12+5} = 0.89\,A$ $\left(\frac{8}{9}\right)$

When 2A is active



$(12 \| 6) + 3 = 4\ \Omega$

The circuit can be ~~de~~ reduced to -



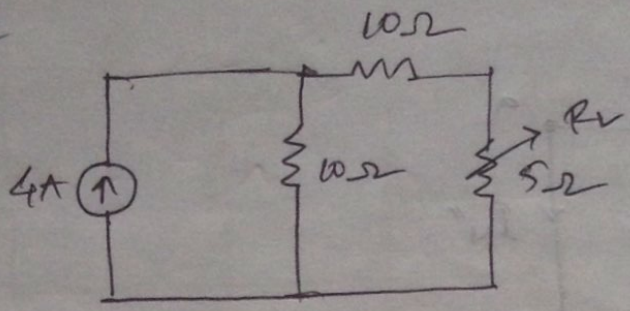
$$\therefore I_N'' = I_{2\Omega} = \frac{4 \times 2}{4+2} = 1.33A \left(\frac{4}{3}\right)$$

$$\therefore I_N = I_N' + I_N'' = 0.89 + 1.33 = 2.22A \left(\frac{20}{9}\right)$$

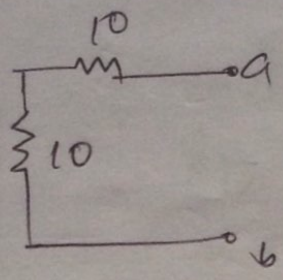
$$\therefore V_{Th} = I_N R_{Th} = 2.22 \times 9 = 19.98V \approx 20V$$

Exercise

4.33

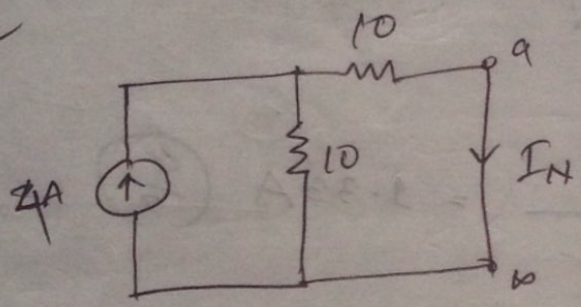


R_{TH}



$R_{TH} = 10 + 10 = 20\Omega$

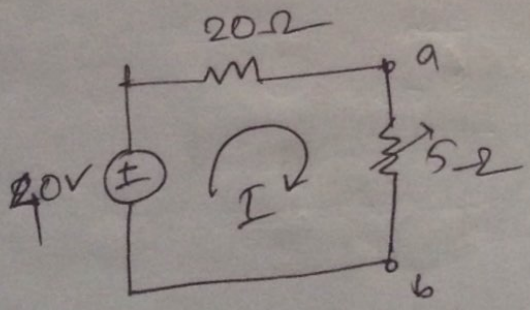
V_{TH}



$\therefore I_N = I_{10} = \frac{10}{10+10} \times 4$

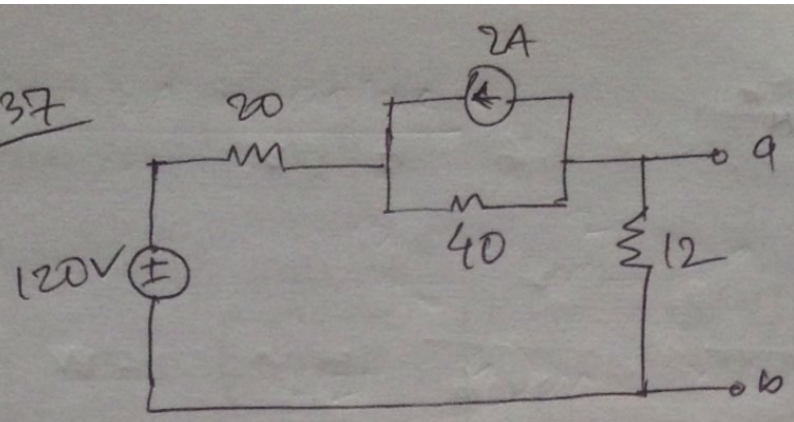
$= 2A$

$\therefore V_{TH} = I_N R_{TH} = 2 \times 20 = 40V$

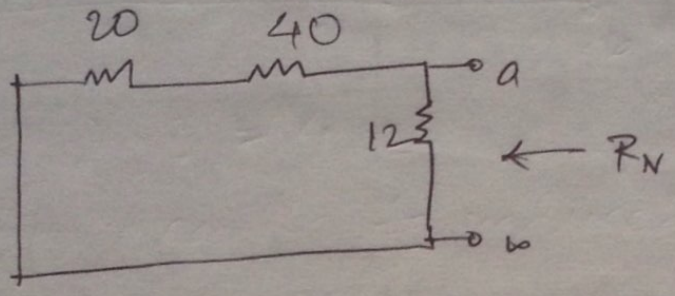


$I_{5\Omega} = I = \frac{40}{20+5} = 1.6A$

4.37

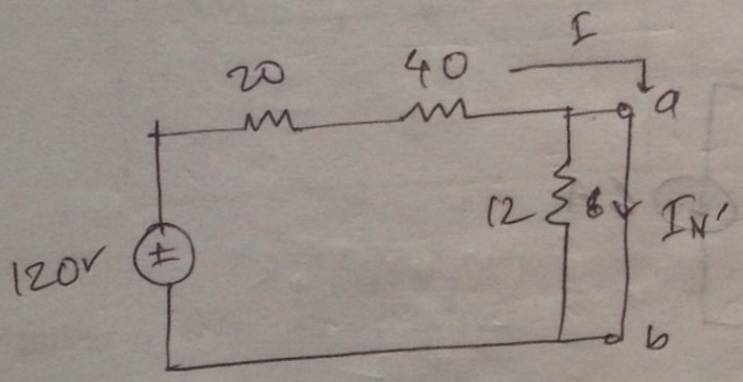


R_N



$$R_N = (20+40) \,||\, 12$$
$$= 10\,\Omega$$

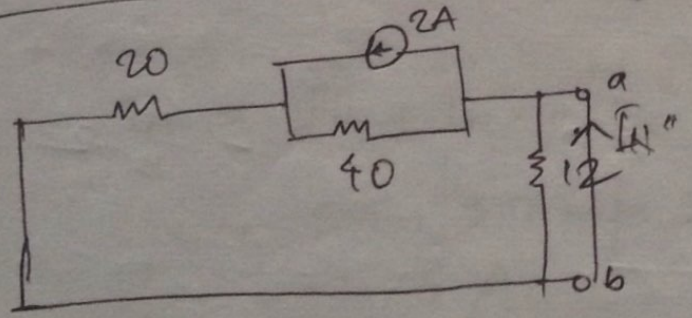
I_N When 120V is active



current won't flow through 12Ω

$$\downarrow I_N' = I = \frac{120}{20+40} = 2A$$

When 2A is active



current won't flow through 12Ω.

$$\uparrow I_N'' = I_{20\Omega} = \frac{40 \times 2}{40+20}$$
$$= \frac{4}{3} A$$

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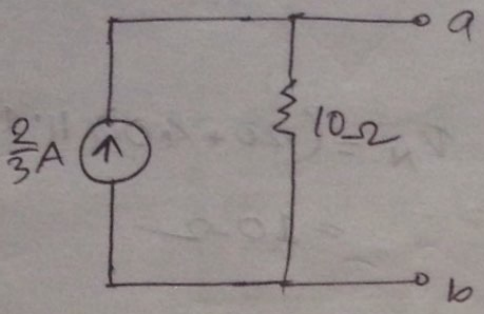
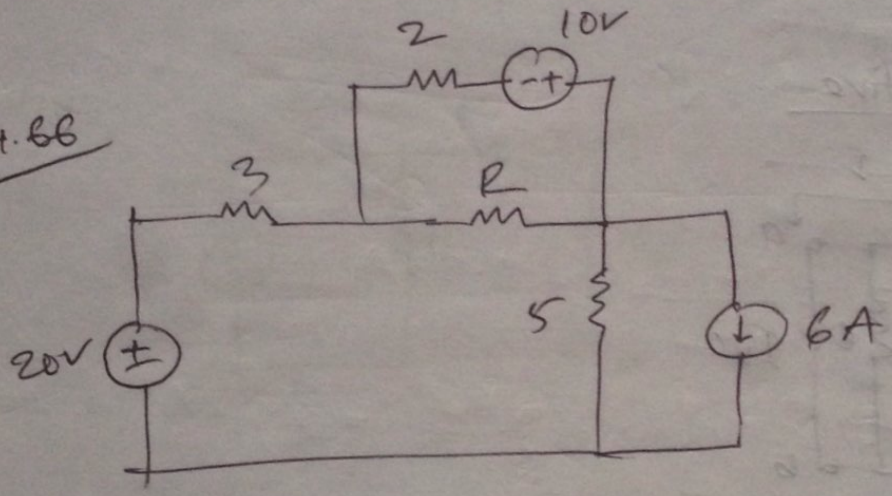
$$\therefore \downarrow I_N = \downarrow I_H' - \uparrow I_H''$$

$$= 2 - \frac{4}{3}$$

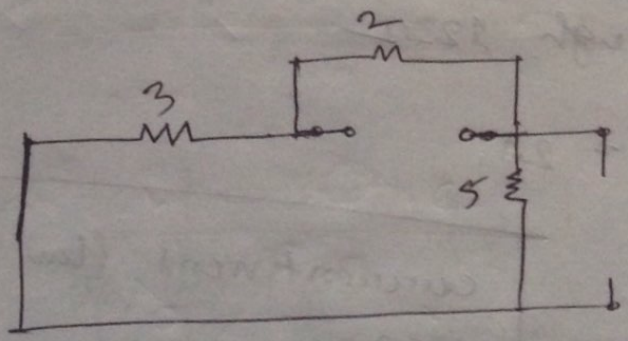
$$= \frac{2}{3} A$$



4.66



R_{TH}

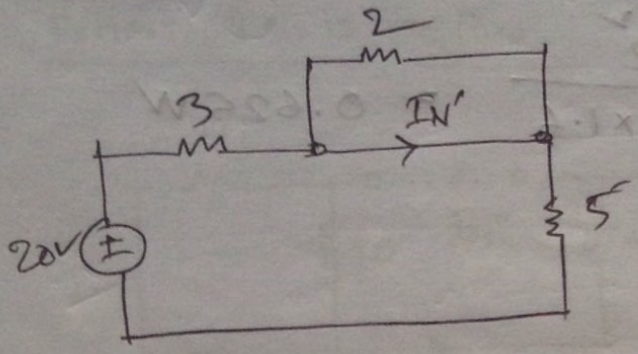


$$R_{TH} = (5+3) \,||\, 2$$

$$= 1.6\ \Omega$$

I_N

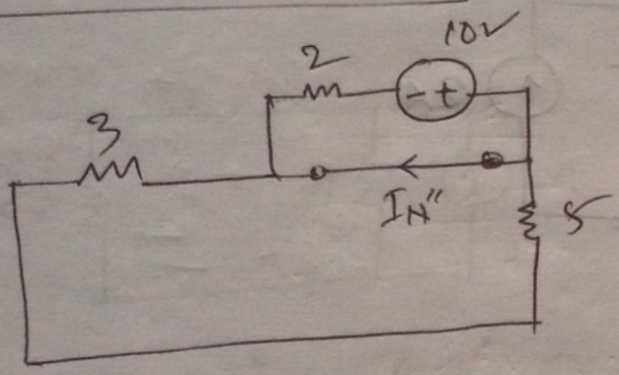
When 20V is active



Current won't flow through 2Ω.

$\therefore \vec{I_N}' = I = \frac{20}{3+5} = 2.5A$

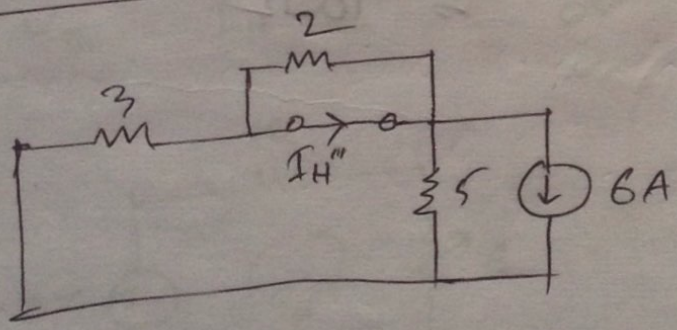
When 10V is active



Current won't flow through 5Ω and 3Ω.

$\therefore \overleftarrow{I_N''} = \frac{10}{2} = 5A$

When 6A is active



Current won't flow through 2Ω.

$\therefore \vec{I_N'''} = I_{3\Omega} = \frac{5 \times 6}{3+5}$

$= 3.75A$

$\therefore I_N = \vec{I_{H_1}} + \vec{I_N'''} - \overleftarrow{I_N''}$

$= 2.5 + 3.75 - 5$

$\therefore \vec{I_N} = 1.25\ A$

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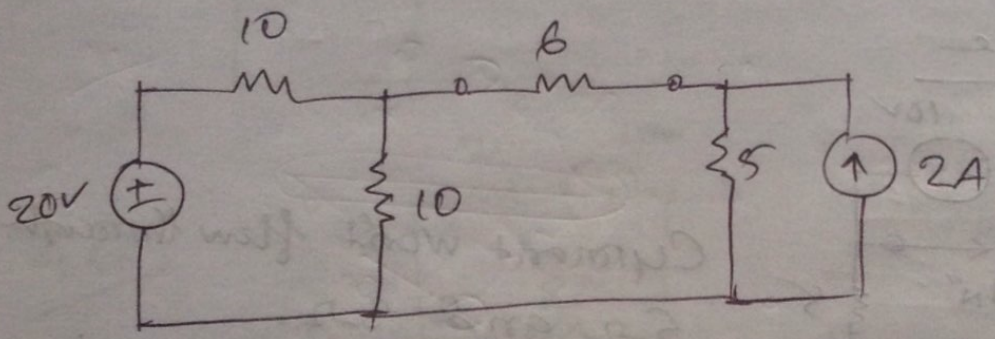
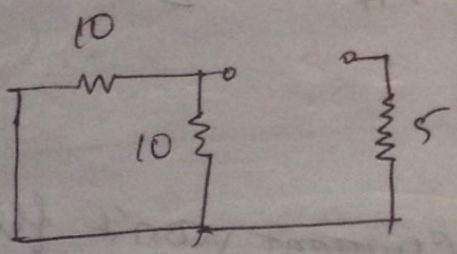
$$\therefore V_{Th} = I_N R_{Th} = 1.25 \times 1.6 = 2V$$

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}} = \frac{2^2}{4 \times 1.6} = 0.625W$$

4.43

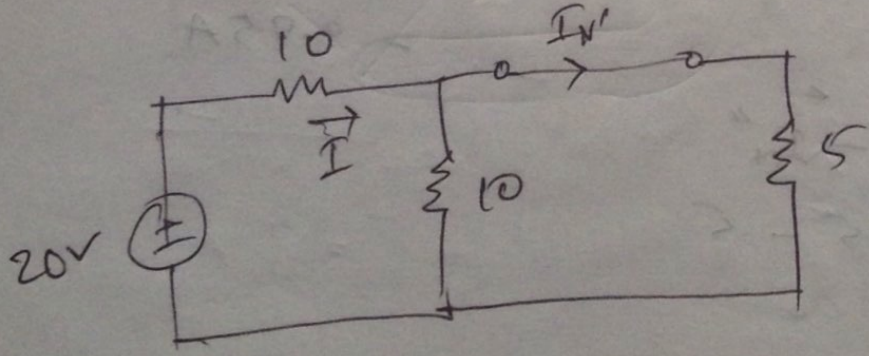


R_{Th}



$$R_{Th} = (10 \parallel 10) + 5$$
$$= 10\Omega$$

V_{Th} When 20V is active



$$R_{eq} = (10 \parallel 5) + 10$$
$$= \frac{40}{3}\Omega$$

$$\therefore I = \frac{20}{\frac{40}{3}} = 1.5A$$

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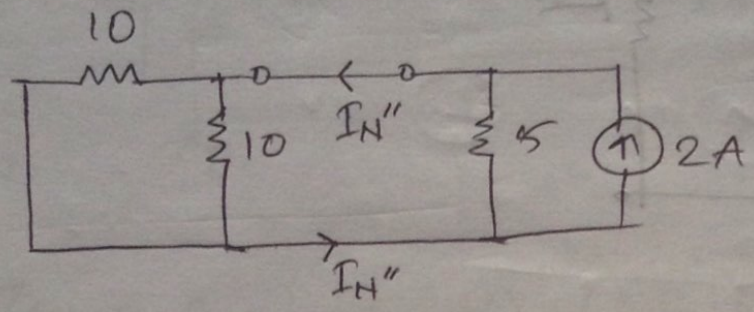
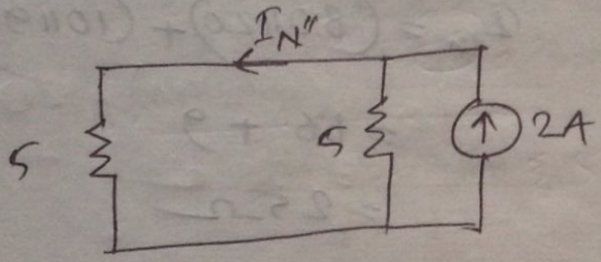
$$\therefore \vec{I_H'} = I_{5\Omega} = \frac{10 \times 1.5}{10+5} = 1A$$

When 2A is active



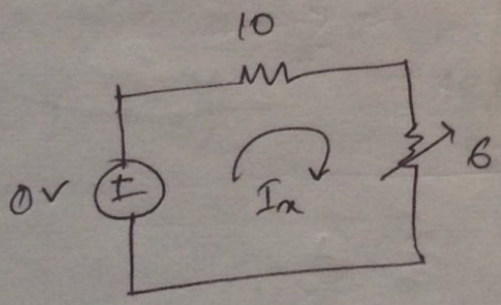
$10 \parallel 10 = 5\Omega$



$$\overleftarrow{I_H''} = \frac{5 \times 2}{5+5} = 1A$$

$$\therefore I_H = \vec{I_H'} - \overleftarrow{I_H''} = 1 - 1 = 0A$$

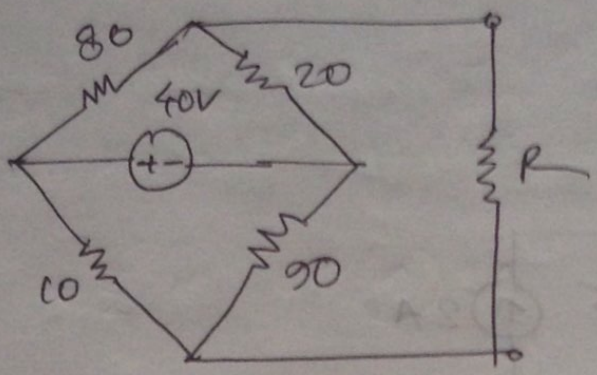
$$\therefore V_{Th} = I_H R_{Th} = 0V$$



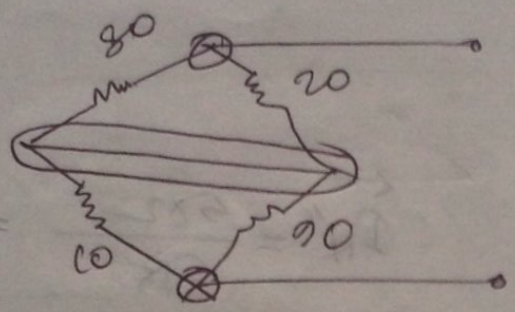
$$I_x = \frac{0}{10+6} = 0A$$

AU4 - 15

(3)(b)



R_{TH}



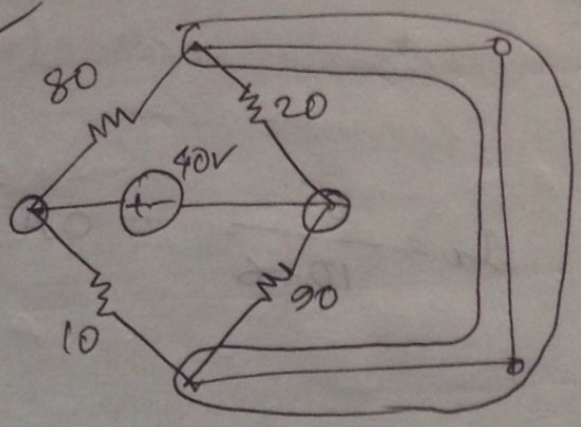
$$R_{TH} = (80 \| 20) + (10 \| 90)$$

$$= 16 + 9$$

$$= 25\,\Omega$$

R must be 25 Ω for maximum power.

V_{TH}



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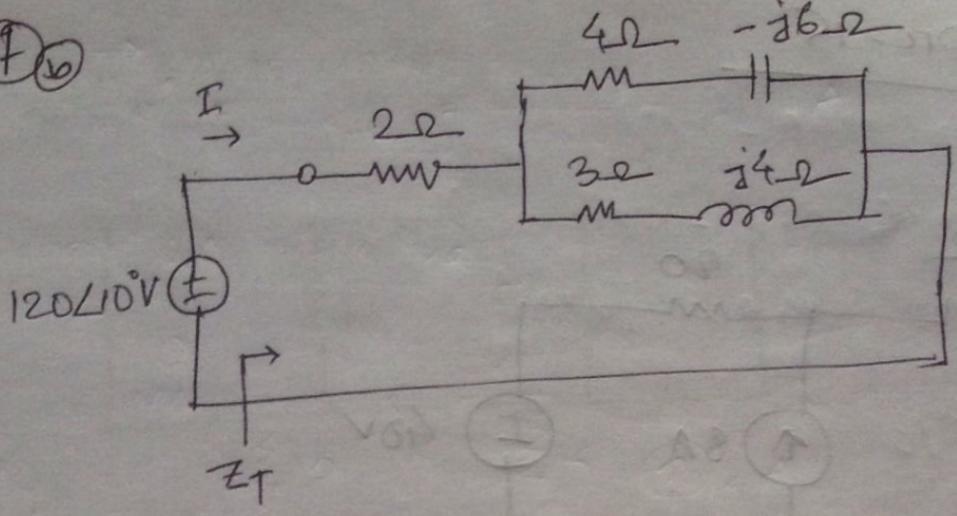
(7)(16)



$$Z_T = 2 + \{(4 - j6) \parallel (3 + j4)\}$$

$$= 2 + \frac{(4 - j6)(3 + j4)}{4 - j6 + 3 + j4}$$

$$= 2 + \frac{36 - 2j}{7 - j2}$$

$$= 2 + 4.83 + j1.09$$

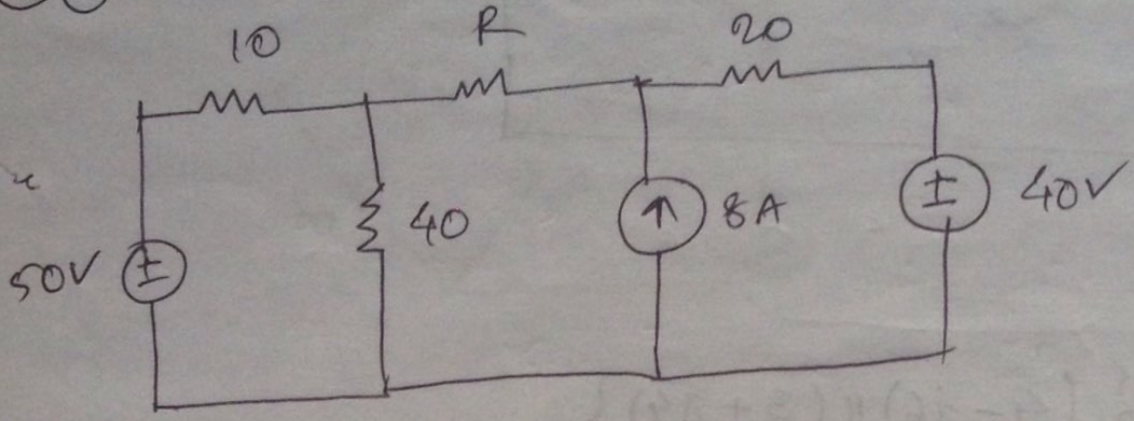
$$\therefore Z_T = 6.83 + j1.09$$

$$= 6.92 \angle 9.1^\circ$$

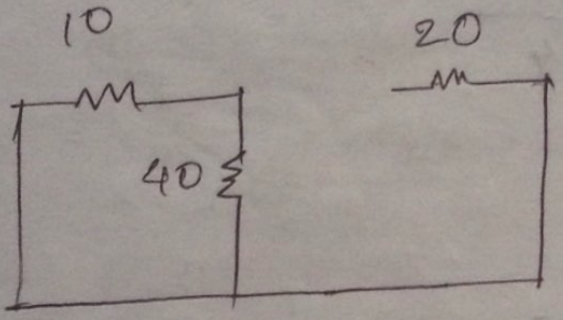
$$\therefore I = \frac{V}{Z_T} = \frac{120\angle 10^\circ}{6.92\angle 9.1^\circ} = 17.35 \angle 0.9^\circ$$ (Ans)

Spr-15

(3) (b)



R_{Th}

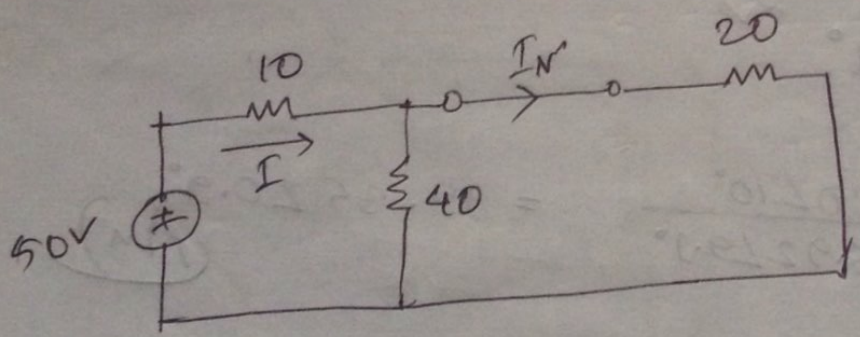


$R_{Th} = (10 \parallel 40) + 20$

$= 28\ \Omega$

V_{Th}

When 50V is active



$R_{eq} = (20 \parallel 40) + 10$

$= \frac{70}{3}$

$\therefore I = \frac{50}{70/3} = \frac{15}{7}$ A

$\therefore \vec{I_N'} = I_{20\Omega} = \frac{40 \times \frac{15}{7}}{40+20} = \frac{10}{7}$ A

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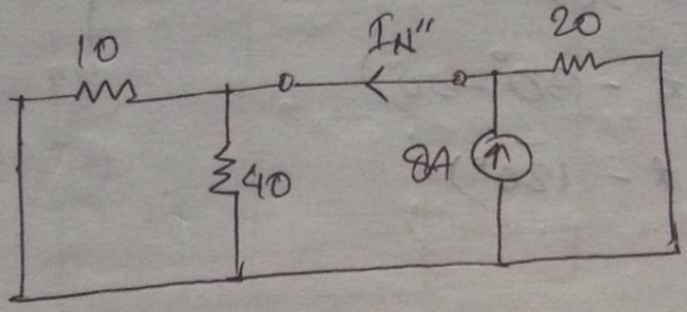
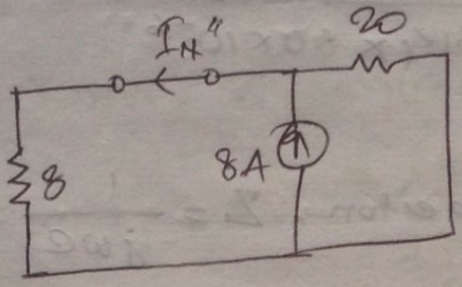
When 8A is active

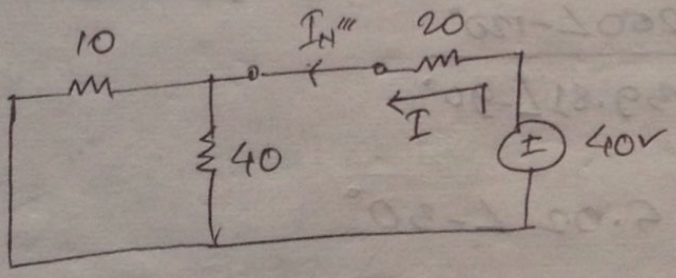


$10 \parallel 40 = 8\,\Omega$



$$\therefore \overleftarrow{I_N''} = \frac{20 \times 8}{20+8} = \frac{40}{7} A$$

When 40 V is active



$$R_{eq} = (10 \parallel 40) + 20$$
$$= 28\,\Omega$$

$$\therefore I = \frac{40}{28} = \frac{10}{7} A$$

$$\therefore \overleftarrow{I_N'''} = I = \frac{10}{7} A.$$

$$\therefore I_N = \overleftarrow{I_N''} + \overleftarrow{I_N'''} - \overrightarrow{I_N'}$$
$$= \frac{10}{7} + \frac{40}{7} - \frac{10}{7}$$

$$\therefore \overleftarrow{I_N} = \frac{40}{7} A$$

$$\therefore V_{Th} = I_N \times R_{Th}$$
$$= \frac{40}{7} \times 28$$
$$= 160 V$$

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}} = 228.57 W$$

Ans.