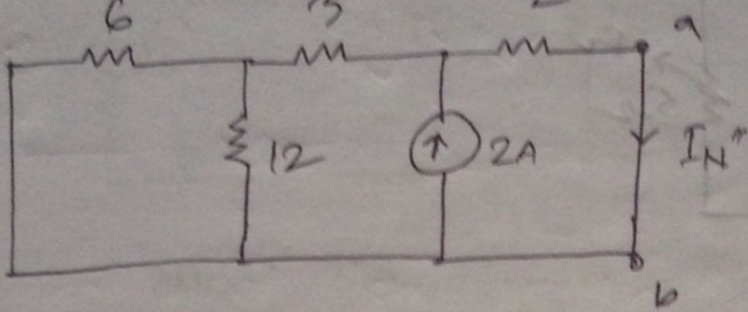
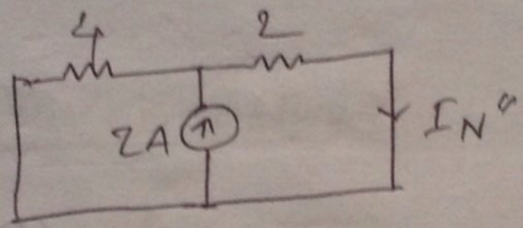
When 2A is active



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

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



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

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

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

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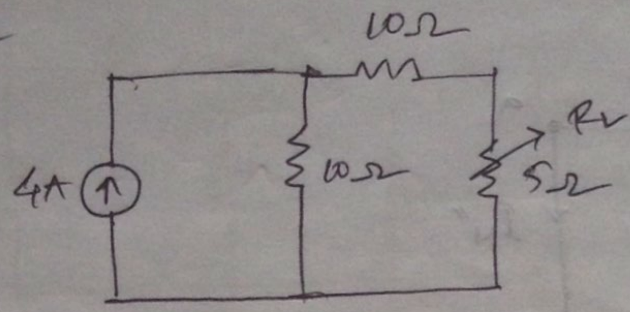
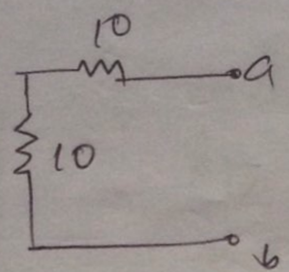
Exercise

4.33

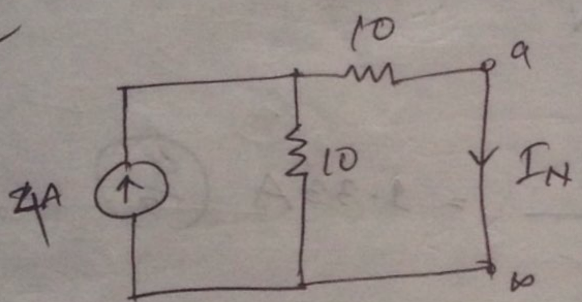


R_{TH}



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

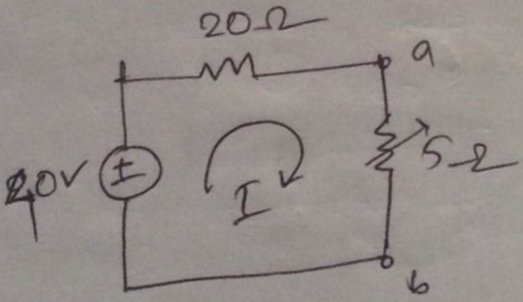
V_{TH}



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

$= 2A$

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



$I_{5\Omega} = I = \frac{40}{20+5} = \cancel{0.8A}$ 1.6A

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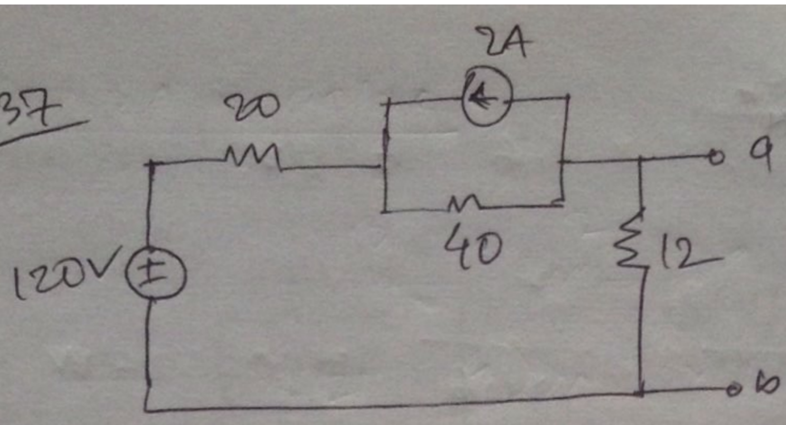
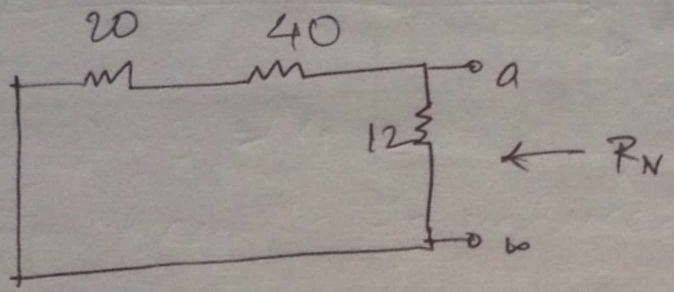
4.37



R_N

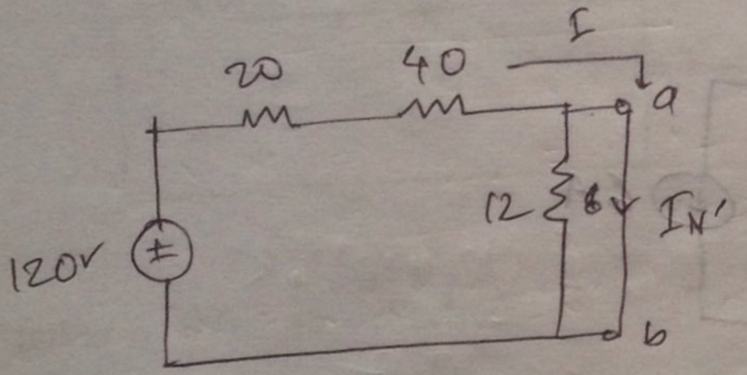


$R_N = (20+40) \parallel 12$

$= 10\Omega$

I_N

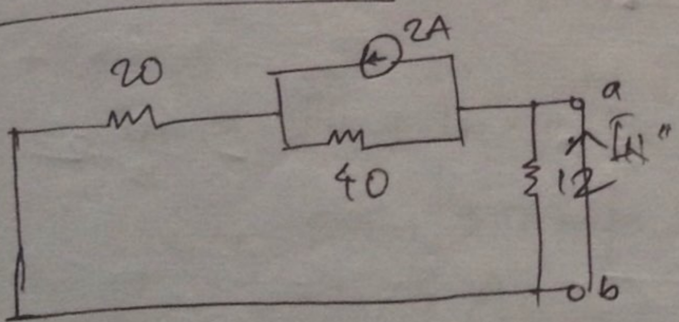
When 120V is active



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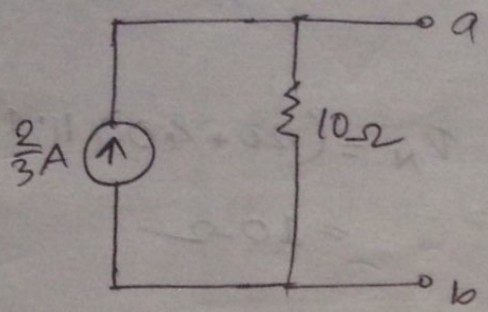
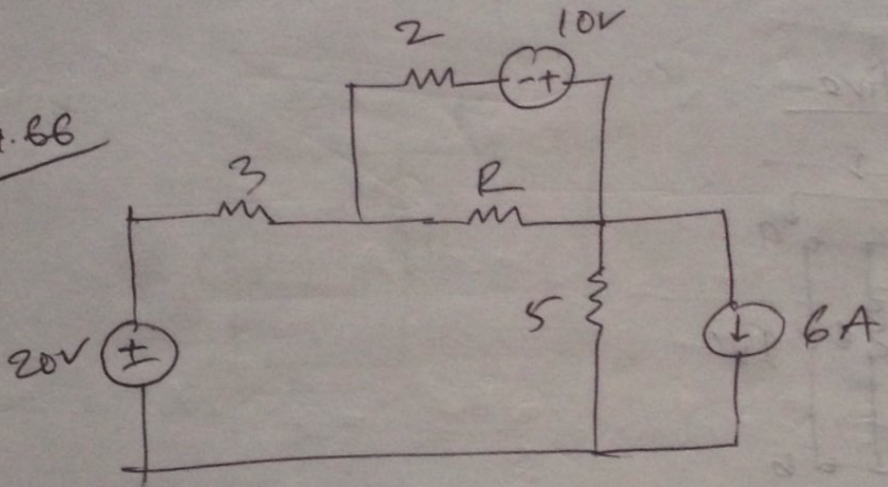
$$\therefore \downarrow I_N = \downarrow I_N' - \uparrow I_N''$$

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

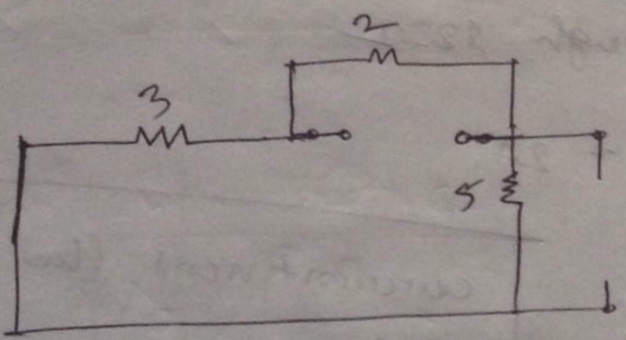
$$= \frac{2}{3} A$$



4.66



R_{Th}

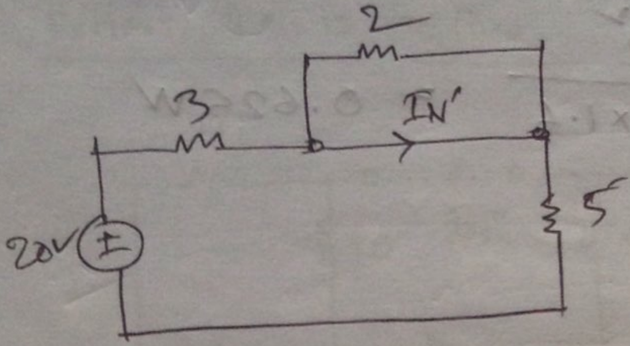


$$R_{Th} = (5+3) \parallel 2$$

$$= 1.6 \Omega$$

I_N

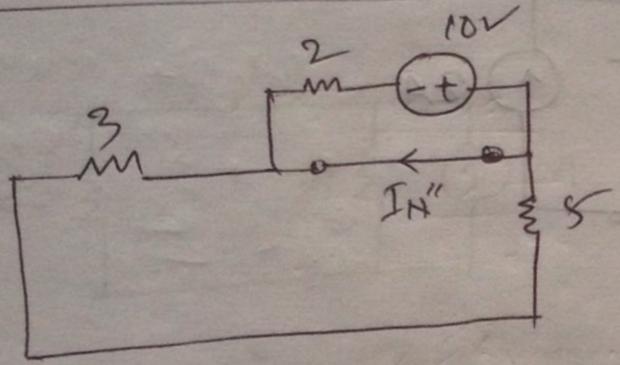
When 20V is active



Current won't flow through 2Ω.

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

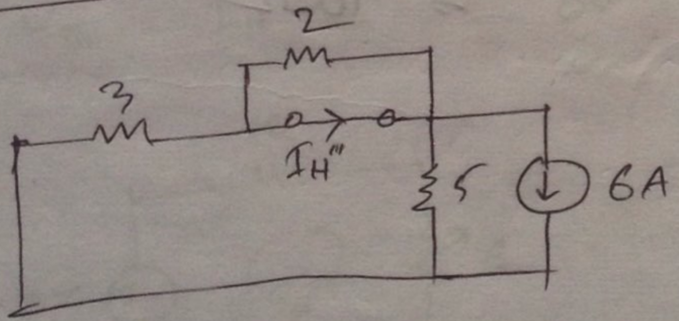
When 10V is active



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.

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

$$= 3.75A$$

$$\therefore I_N = \overrightarrow{I_{N'}} + \overrightarrow{I_N'''} - \overleftarrow{I_N''}$$

$$= 2.5 + 3.75 - 5$$

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

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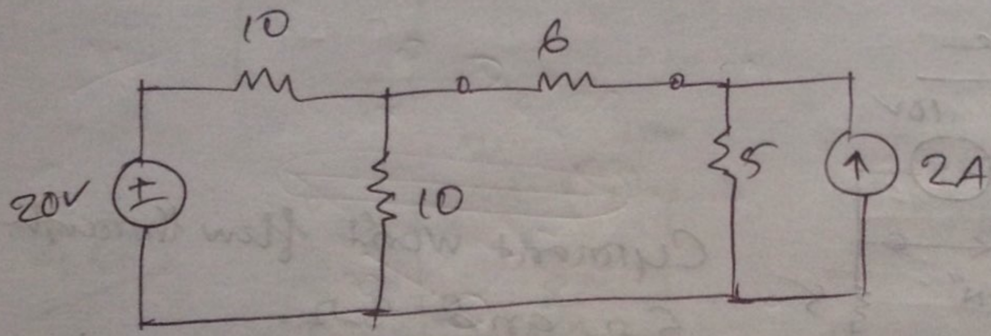
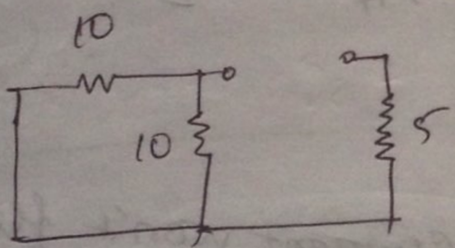
$\therefore V_{Th} = I_H R_{Th} = 1.25 \times 1.6 = 2V$

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

4.43

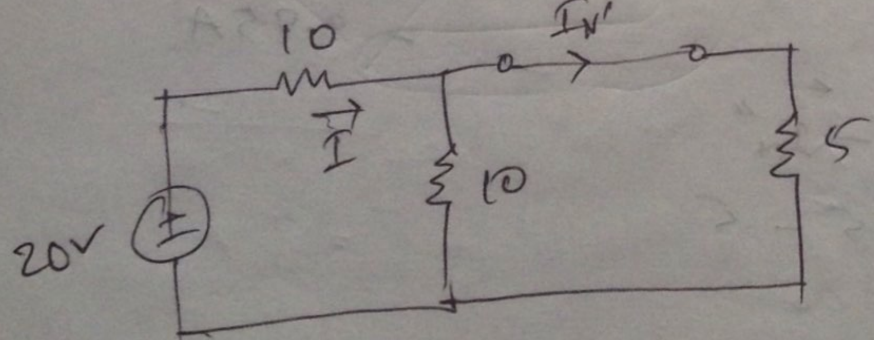


R_{Th}



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

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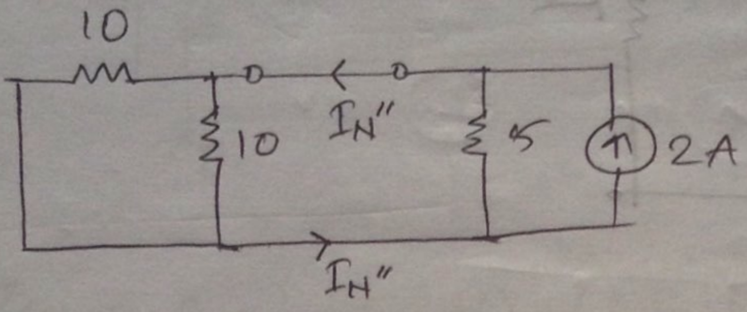
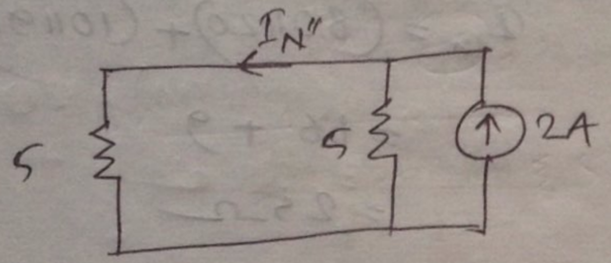
$$\therefore \vec{I_H}' = I_{5\Omega} = \frac{10\times 1.5}{10+5} = 1A$$

<u>When 2A is active</u>



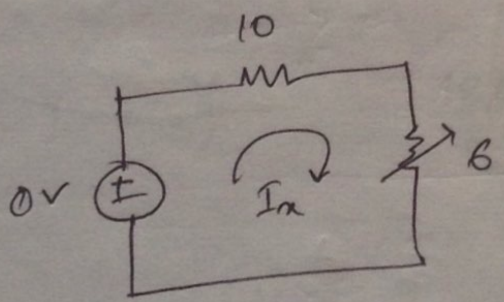
$$10 \parallel 10 = 5\Omega$$



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

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

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



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

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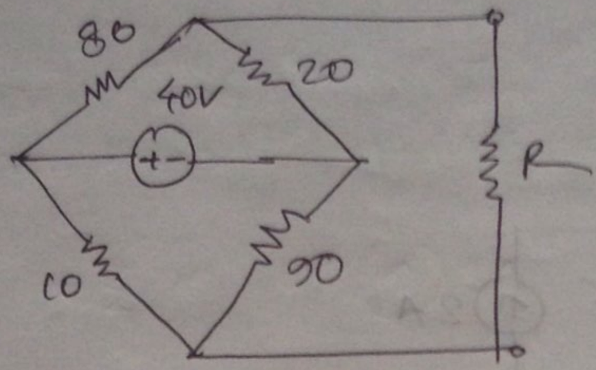
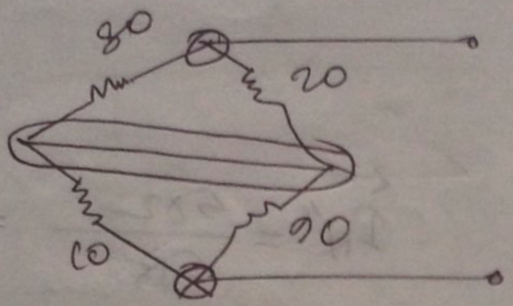
AUT-15

3(b)



R_{TH}



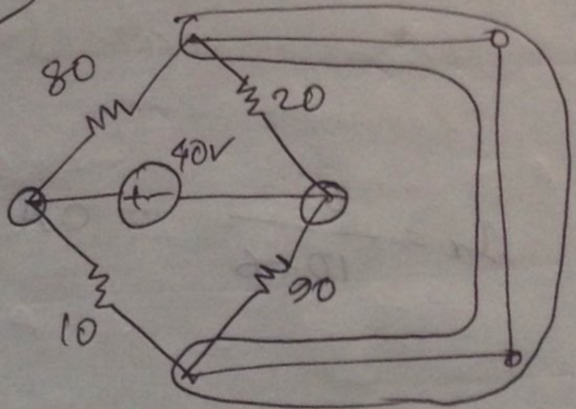
$R_{TH} = (80 \| 20) + (10 \| 90)$

$= 16 + 9$

$= 25\,\Omega$

R must be $25\,\Omega$ for maximum power.

V_{TH}



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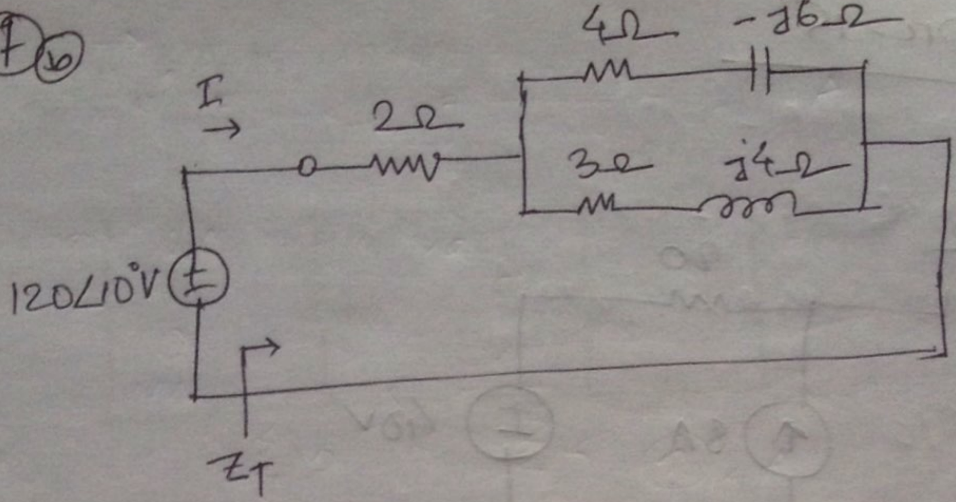
7 (b)



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

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

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

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

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

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

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

Ans

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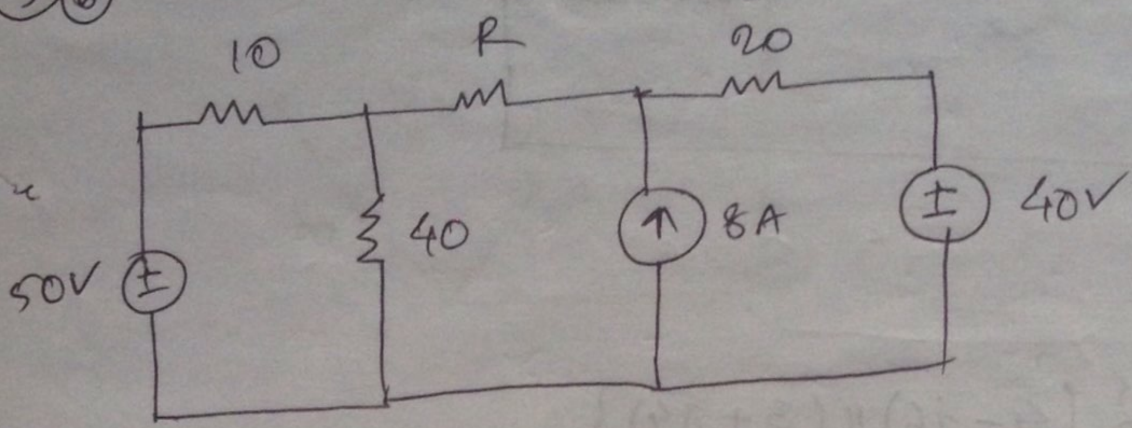
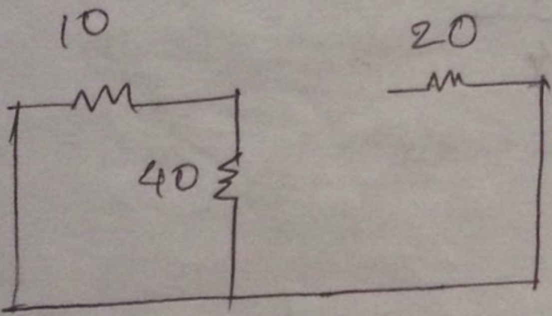
SPR-15

3(b)



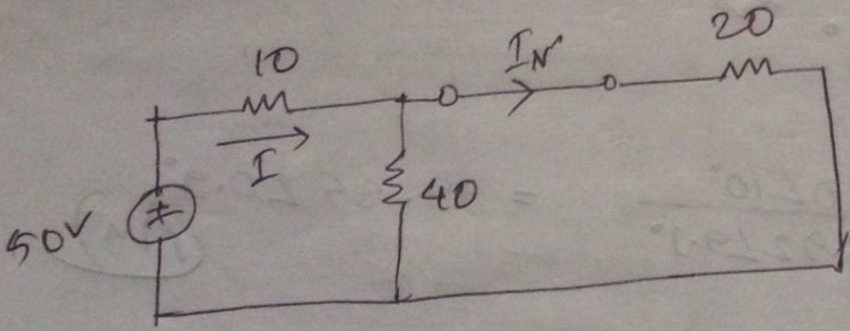
R_{Th}



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

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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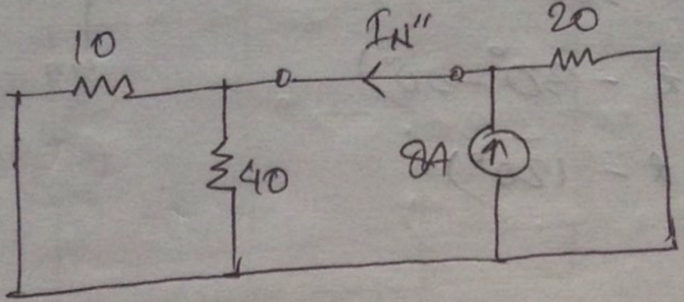
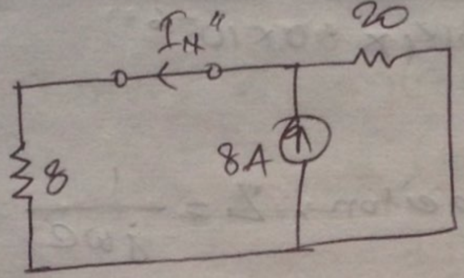
When 8A is active

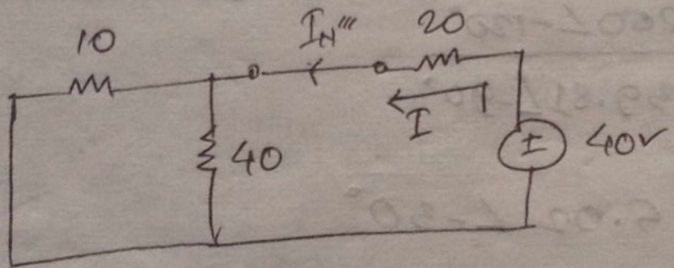


$10 \parallel 40 = 8\Omega$



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

When 40V is active



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

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

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

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

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

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

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

An.

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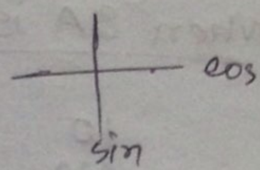
7 (a)



$$v = 200 \sin(314t - 30^\circ)$$
$$= 200 \cos(314t - 30^\circ - 90^\circ)$$
$$= 200 \cos(314t - 120^\circ)$$

$\omega = 314$ rad/s

$$\text{Reactance} = \frac{1}{\omega C} = \frac{1}{314 \times 80 \times 10^{-6}} = 39.81\ \Omega$$

Impedance of $80\mu F$ capacitor, $Z = \frac{1}{j\omega C}$

$$= -j39.81\ \Omega$$
$$= 39.81 \angle -90^\circ$$

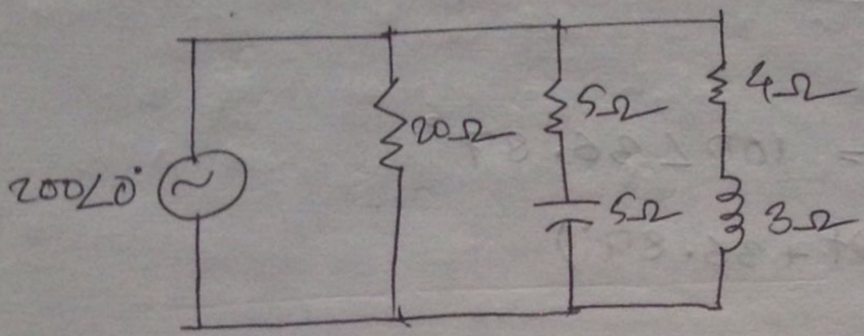
$$\therefore I = \frac{V}{Z} = \frac{200\angle -120^\circ}{39.81\angle -90^\circ}$$

$$= 5.02 \angle -30^\circ$$

$$= 5.02 \cos(314t - 30^\circ)$$

(Ans)

(b)



~~Q1<<<4~~

Total Impedance, $Z_T = \{(4+3) \parallel (5+5)\} \parallel 20$

$= (7 \parallel 10) \parallel 20$

$= \frac{140}{41}\,\Omega = \frac{140}{41}\angle 0^\circ$

Total Admittance, $Y = \frac{1}{Z_T} = \frac{41}{140}$ S

$\therefore$ Total current $= \frac{200\angle 0^\circ}{\frac{140}{41}\angle 0^\circ} = 58.57\angle 0^\circ$

Power supplied by source,

$P = \frac{V^2}{Z_T} = \frac{(200\angle 0^\circ)^2}{\frac{140}{41}\angle 0^\circ} = 11.71$ kW

(Ans)

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Aut-14

7 c $V = 80 + j60^\circ = 100\angle 36.87^\circ$

$= 100\cos(\omega t + 36.87^\circ)$

$I = -4 + j10^\circ = 2\sqrt{29}\angle 111.80^\circ$

$= 2\sqrt{29}\cos(\omega t + 111.80^\circ)$

Impedance, $Z_T = \frac{V}{I} = 9.28\angle -74.93^\circ$

$P = \frac{V^2}{Z_T} = 1077\angle 148.67 \text{ W}$