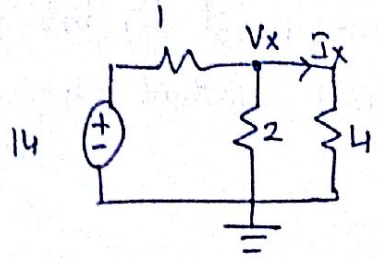
Solutions of Group Exercise.

1)



KCL at V_x

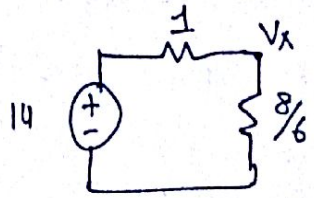
$$\frac{V_x - 14}{1} + \frac{V_x}{2} + \frac{V_x}{4} = 0$$

$$4V_x - 56 + 2V_x + V_x = 0$$

$$V_x = 8V$$

$$\therefore I_x \ \frac{8}{4} = 2A$$

b)



$$V_x = \left(\frac{\frac{8}{6}}{1+\frac{8}{6}}\right)14 = \frac{4}{7} \times 14 = 8V$$

$$I_x = \frac{2}{6} \cdot I_{total}$$

$$I_{Total} = \frac{14}{7} \times 3 = 6A$$

$$\therefore I_x = 2A$$

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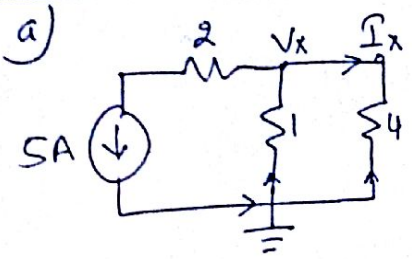
2) a)



KCL at V_x $\quad \frac{V_x}{1} + \frac{V_x}{4} + 5 = 0$

$$V_x = -4V$$

$$I_x = -1A$$

b $\quad I_x = -\left(\frac{1}{5}\right) \times 5A$

$$= -1\ A$$

$$V_x = I_x \cdot 4 = -4V$$

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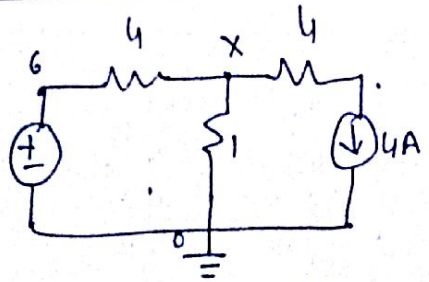
3)



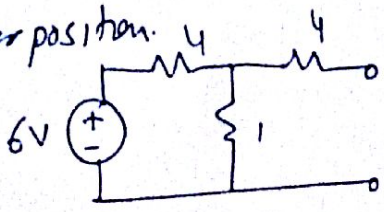
KCL at x $\quad \frac{x-6}{4} + \frac{x}{1} + 4 = 0$

$$x - 6 + 4x + 16 = 0$$

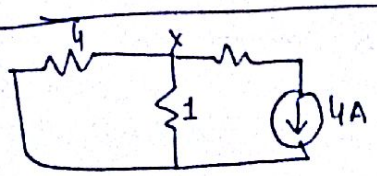
$$5x = -10$$

$$x = -2V$$

By Superposition.



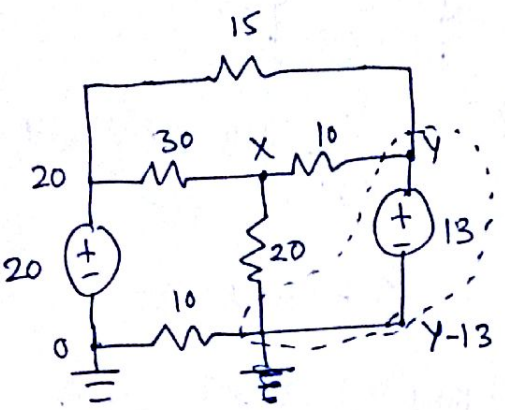
$$= V_x = \frac{1}{5} \times 6\ V$$



$$= V_x = \frac{8}{5} - \frac{4}{5} \times 4\ V = \frac{-16}{5}\ V$$

$$\therefore V_x = \frac{6}{5} - \frac{16}{5} = -2V$$

4) When no specific method is mentioned in the question, the you are free to choose any method for circuit analysis.



KCL at X

$$\frac{X-20}{30} + \frac{X-Y}{10} + \frac{X-(Y-13)}{20} = 0$$

$$2X - 40 + 6X - 6Y + 3X - 3Y + 39 = 0$$

$$11X - 9Y = 1 \quad \text{--- (1)}$$

KCL at super node Y.

$$\frac{Y-13-0}{10} + \frac{Y-13-X}{20} + \frac{Y-X}{10} + \frac{Y-20}{15} = 0$$

$$6Y - 78 + 3Y - 39 - 3X + 6Y - 6X + 4Y - 80 = 0$$

$$-9X + 19Y = 197 \quad \text{--- (11)}$$

$\therefore X = 14, \quad Y = 17$

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5) I'll briefly discuss the solutions now onwards.

KCL at X $\quad \frac{X-240}{3} + \frac{X-6}{6} + 10 = 0$

KCL at Y. $\quad \frac{Y-X}{6} + \frac{Y}{24} + \frac{Y-60}{12} = 0 \Rightarrow X = 180, \; Y = 120$

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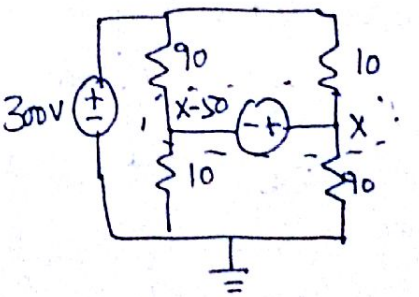
6) KCL at X

$$\frac{(X-50)-300}{90} + \frac{X-50}{10} + \frac{X-300}{10} + \frac{X}{90} = 0$$

$X = 175V$



7) $I = \frac{X-1}{125}$

KCL at X $\quad \frac{X-10}{1} + \frac{X-1}{125} + 99I = 0$

$\Rightarrow \quad X = 6\,V \;, \quad I = \frac{5}{125}\,A$

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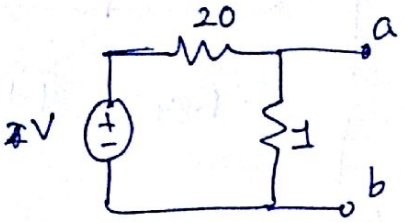
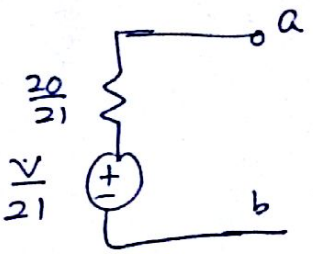
8) For thevenin eq. we need to find V_{oc} and R_{TH}.



$V_{oc} = \frac{1}{21} \times V = \frac{V}{21}$

$R_{TH} = \frac{20}{21}\,\Omega$



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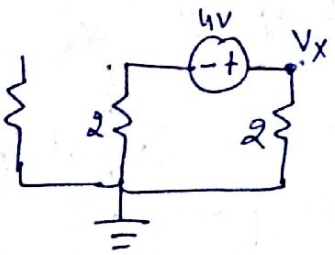
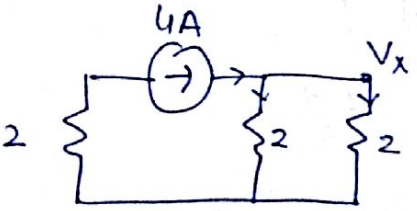
9) By Considering 4V



$\therefore V_{x_1} = 2V$

By Considering 4A



$V_{x_2} = 2 \times 2 = 4V$

$\therefore \quad V_x = 6V$

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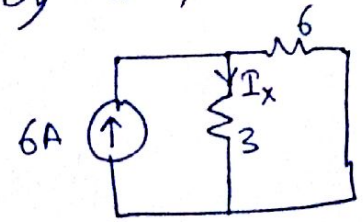
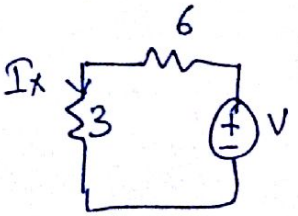
10) By Considering 6A



$I_{x_1} = \frac{6}{3+6} \times 6 = 4\,A$

By Considering V

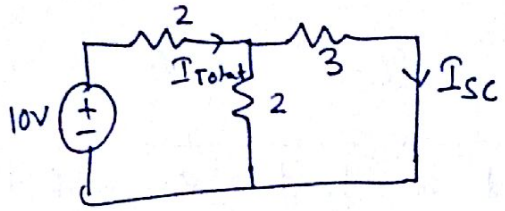


$I_{x_2} = \frac{V}{9}\,A$

$\therefore \quad I_x = \left(4 + \frac{V}{9}\right) A$

11) Norton eq across 3V sour.

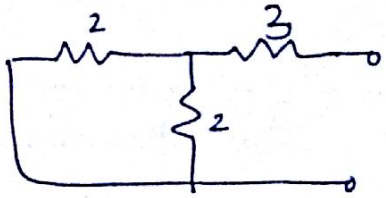
To find I_{sc}, we shot ckt 3V



$$I_{total} = \frac{10}{2 + \frac{6}{5}} = \frac{50}{16} A$$

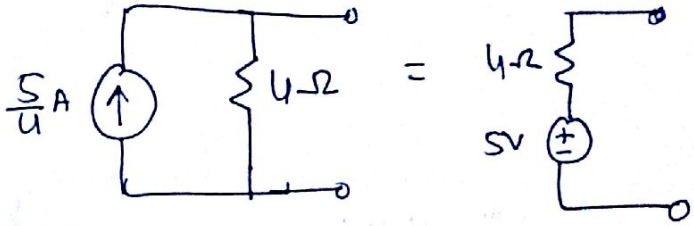
$$I_{sc} = \frac{2}{5} I_{total} = \frac{\cancel{50}^{10}}{16} \times \frac{2}{\cancel{5}} = \frac{5}{4} A$$

To find R_{No}, openckt and zero sources.



$\therefore R_{TH} = 4\Omega$.

$\therefore$



12) KCL at Y.

$$\frac{Y-4}{1} + \frac{Y-X}{5} = 0$$

also $X = -6Y$

$\therefore$ solving these we get

$X = -10V$