Q1: In the circuit shown, prove that $\sum P = 0$.

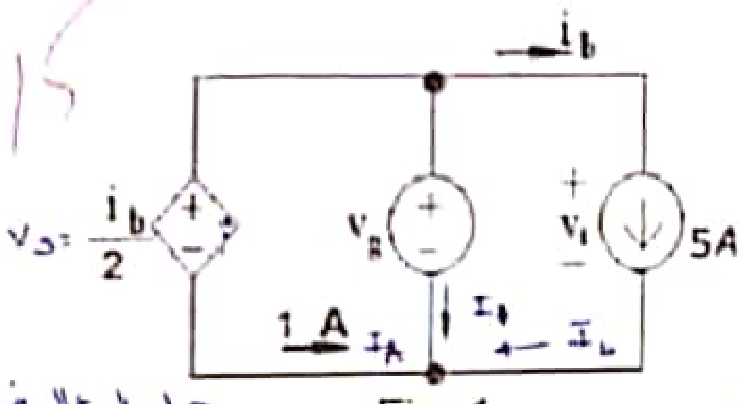


Fig. 1

$i_b = 5A$

$V_s = \frac{i_b}{2} = \frac{5}{2} = 2.5V$

$V_g = 2.5V$

$V_1 = -2.5V$

$I_A + I_b + I_1 = 0$

$I_A + 5 + 1 = 0$

$I_A = -6$

Q2: In the circuit shown in Fig. 2, use nodal analysis method to find the current I_L

using KCL :-

KCL at node a :-

Q.

$i_b = 5A$

$V_3 = 2.5V$

$V_g = 2.5V$

$V_1 = 2.5V$

$i_A + i_1 + i_b = 0$

$i_A + 5 + 1 = 0$

$i_A = -6A$

$P_{V_3} = VI$

$= (2.5)(-6)$

$= -15$ Watt

$P_{V_3} = VI$

$= 2.5(1)$

$= 2.5$ watt

$P_{5A} = VI$

$= 2.5(5)$

$= 12.50$ watt

$\Sigma P = -15 + 2.5 + 12.5$

$= 0$

Q2: In the circuit shown in Fig. 2, use nodal analysis method to find the current I_L

20/20

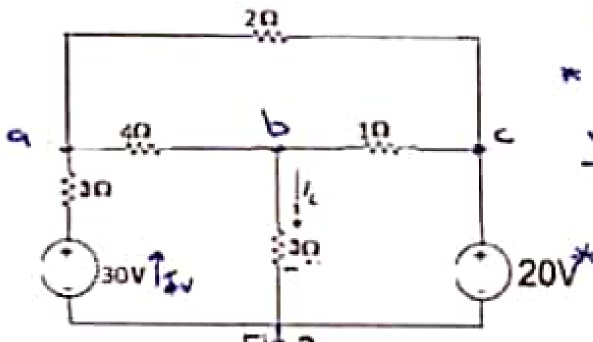


Fig.2

using KCL :-

* KCL at node a :-

$$\frac{V_a - V_c}{2} + \frac{V_a - V_b}{4\Omega} - I_v = 0$$

* KCL at node b :-

$$\frac{V_b - V_c}{1} + \frac{V_b - V_a}{4} + \frac{V_b}{3} = 0$$

→ $V_c - 0 = 20V$ → $V_c = 20\ V$

→ $V_a - 0 = 30 - 3I_v$

$V_a + 3I_v = 30$

$\frac{3}{4}V_a - \frac{V_b}{4} - I_v = 10$ .. ①

$-\frac{V_a}{4} + \frac{19}{12}V_b = 20$ — ②

$V_a + 3I_v = 30$ .. ③

$V_a = 2640/119$

$V_b = 1920/119$

$I_v = 310/119$

$i_L = \frac{V_b}{3}$

$= \frac{640}{119}A$

$= 5.378A$

Q3: Find R_L to transfer the maximum power and the power in the Fig 3.

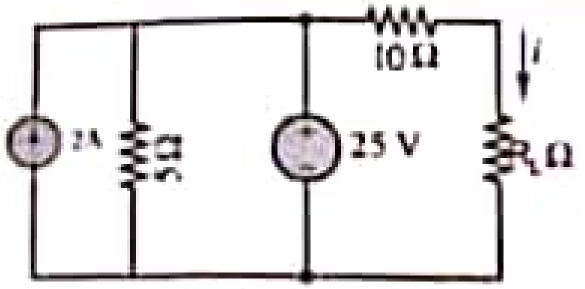
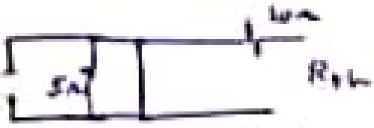


Fig 3

R_{th} , V_{oc}

$V_{oc} = 25\ V$



$R_{th} = 10\ \Omega$

$$* P_{max} = \frac{V_{th}^2}{4R_{th}} = \frac{25^2}{4 \times 10} = \frac{125}{8} \text{ watt}$$

$* R_L = R_{th}$ to transfer the max. power

$R_L = 10\ \Omega$

Q4: In the circuit shown in Fig.4, using mesh analysis method to find the current i_L

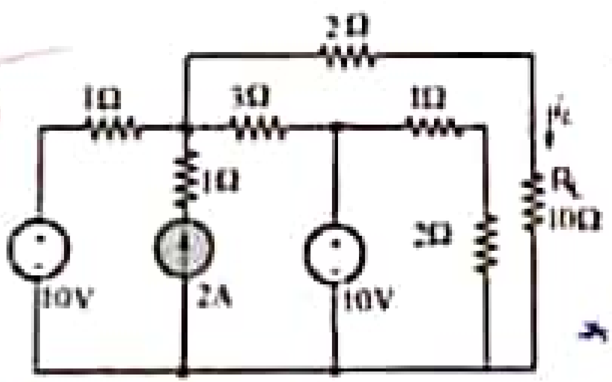
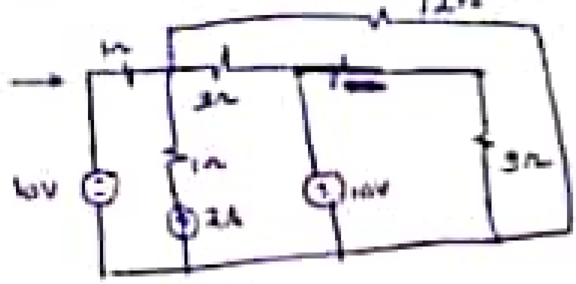
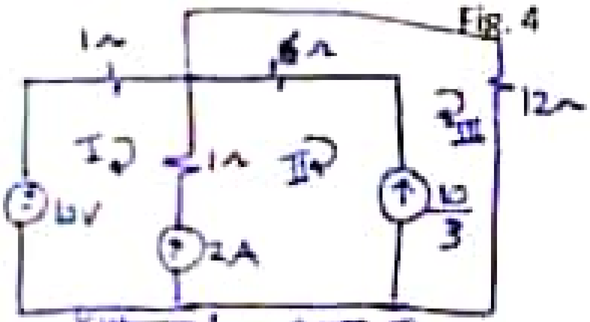


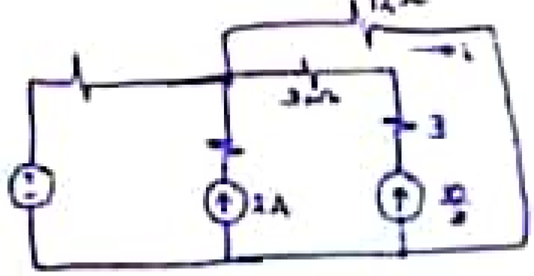
Fig. 4



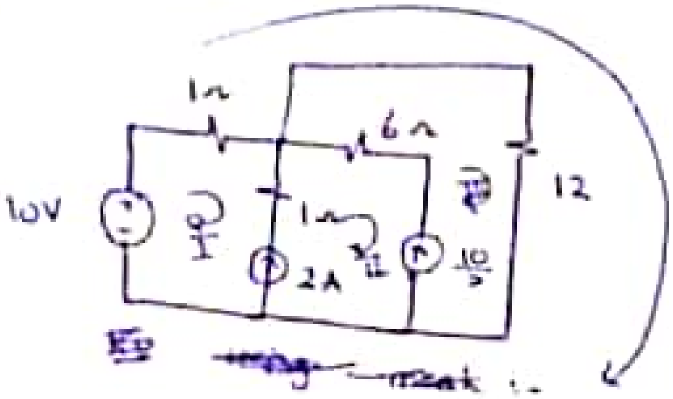
* using source transformation

$I = \frac{10}{3}\ A$





Q4 حل آخر



Supermesh

$-10 + I_1 + 12 I_3 = 0$ ... (1)

$I_2 - I_1 = 2$ ... (2)

$I_3 - I_2 = \frac{10}{3}$ — (3)

$I_1 + 12 I_3 = 10$

$-I_1 + I_2 = 2$

$-I_2 + I_3 = \frac{10}{3}$

$I_1 = -\frac{54}{13} A$

$I_2 = -\frac{28}{13} A$

$I_3 = \frac{46}{39} A$

$I_3 = i = \frac{46}{39} A$

Q5: In the Fig. 5, find I_L by using superposition Principle.

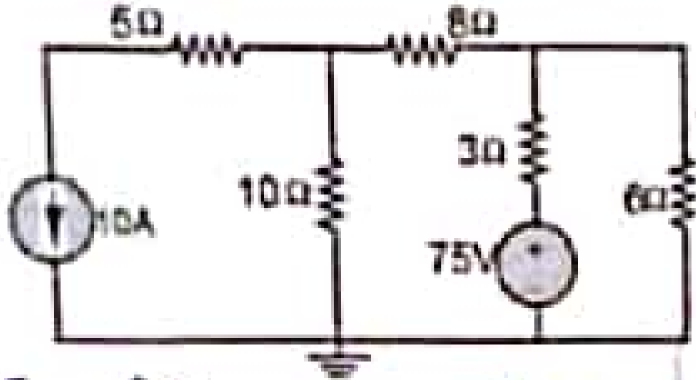
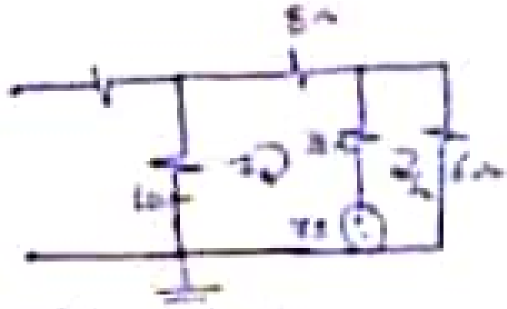


Fig. 5



using KVL :-

KVL at loop I :-

$10I_1 + 8I_1 + 3(I_1 - I_2) + 75 = 0$

$6I_2 + 3(I_2 - I_1) - 75 = 0$

$21I_1 - 3I_2 = -75$

$-3I_1 + 9I_2 = 75$

$I_1' = -\frac{5}{2}$

$I_2 = +\frac{15}{2}$

$R_{eq} = 3 \| 6 = \frac{3 \times 6}{9} = 2\,\Omega$

$R_1 = 2 + 8 = 10\,\Omega$

$R_2 = \frac{10 \times 10}{20} = 5$

$R_{eq} = 5 + 5 = 10\,\Omega$

$I_{5\Omega} = 10A$

$V_{5\Omega} = 10 \times 5 = 50V$

$I_{10\Omega} = \frac{50}{10} = 5A$

$V_{6\Omega} = 5 \times 2 = 10V$

$I''_{6\Omega} = \frac{-10}{2} = -5A$

$I_{6\Omega} = I' + I''$

$= \frac{15}{2} - 5$

$= 2.5A$

Q6: In the circuit shown in Fig. 6, write a set of equations according to mesh current method to solve the unknown currents.

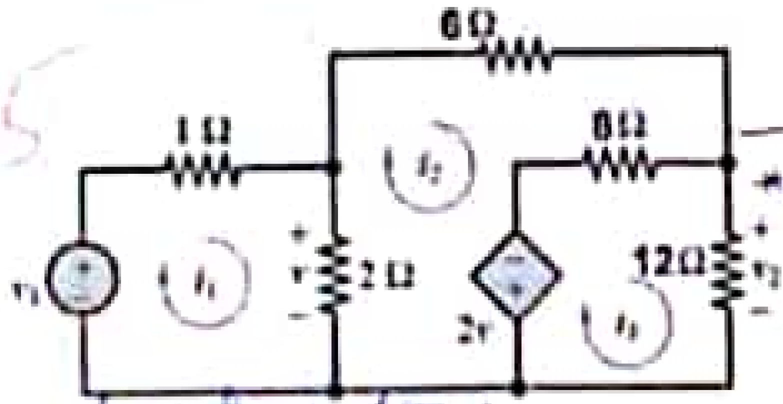


Fig. 6

KVL at i_1 (loop I) :-

$1I_1 + 2(I_1 - I_2) - V_1 = 0$

$3I_1 - 2I_2 - V_1 = 0$ — ①

KVL at i_2 (loop II) :-

$6I_2 + 8(I_2 - I_3) - 2v + 2(I_2 - I_1) = 0$

$v = 2(I_1 - I_2)$

$14I_2 - 8I_3 + 2(I_2 - I_1) - 4(I_1 - I_2)$

$20I_2 - 8I_3 - 6I_1 = 0$

KVL at loop III :-

$8(I_3 - I_2) + 12I_3 + 2(2(I_1 - I_2)) = 0$

$20I_3 - 4I_1 - 4I_2 = 0$ — ③

then set of equations :-

1. $3I_1 - 2I_2 = V_1$
2. $-6I_1 + 20I_2 - 8I_3 = 0$
3. $-4I_1 - 4I_2 + 20I_3 = 0$