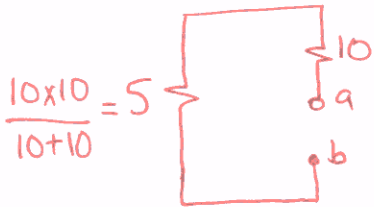
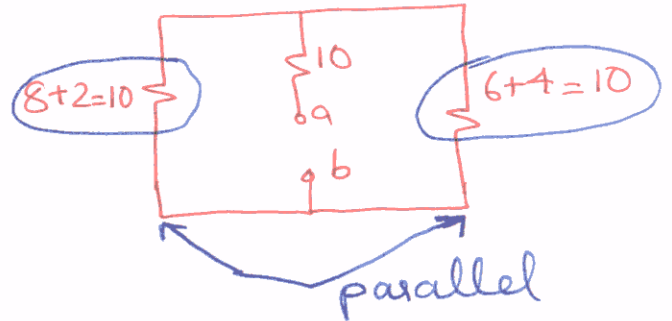
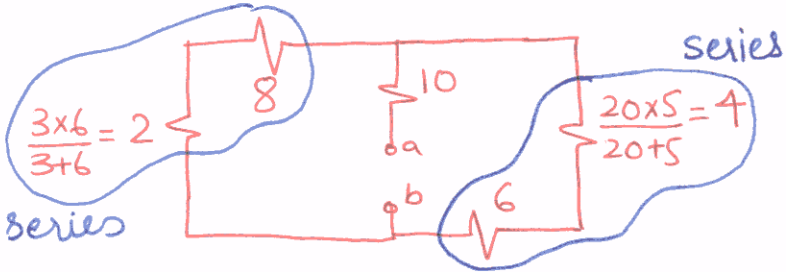
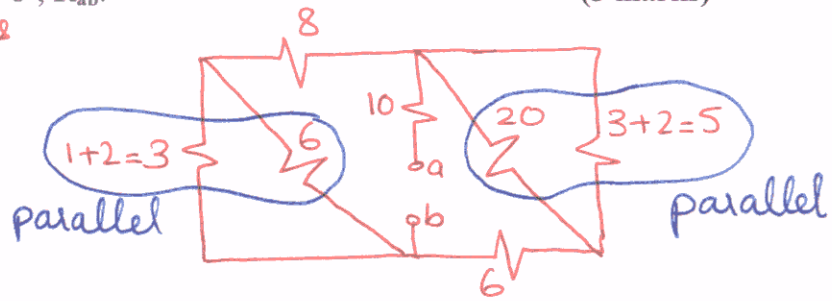
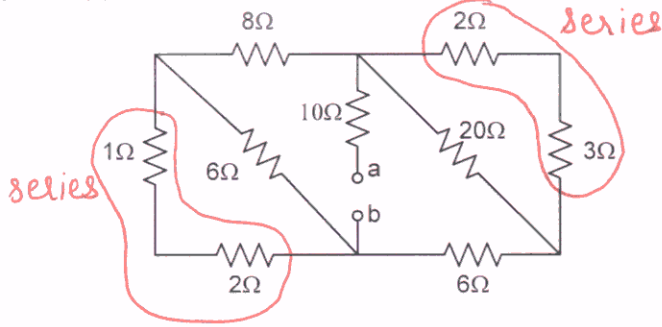


Q#1 (a) Find resistance seen at terminals 'a' and 'b',  $R_{ab}$ .

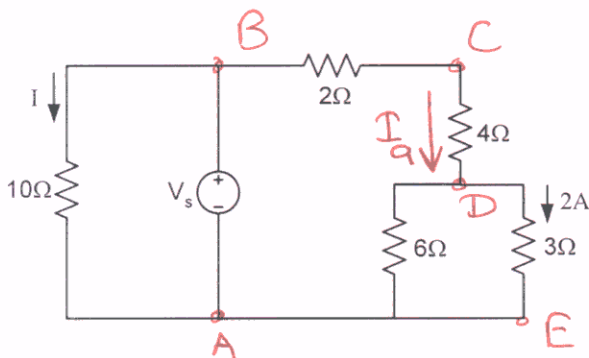
(5 marks)



$$R_{ab} = 10 + 5 = 15\Omega$$

(b) If the current through 3Ω resistor is 2A, using current division, KCL and KVL, find the value of  $V_s$  and  $I$

(3 marks)



Using current division,

$$2 = \frac{6}{6+3} \times I_a \Rightarrow I_a = 3A$$

Apply KVL in ABCDEA loop

$$-V_s + 2I_a + 4I_a + (3)(2) = 0$$

$$\Rightarrow V_s = 6I_a + 6 \Rightarrow V_s = 24 \text{ Volt}$$

$$I = \frac{V_s}{10} = \frac{24}{10}$$

$$\Rightarrow I = 2.4 \text{ A}$$

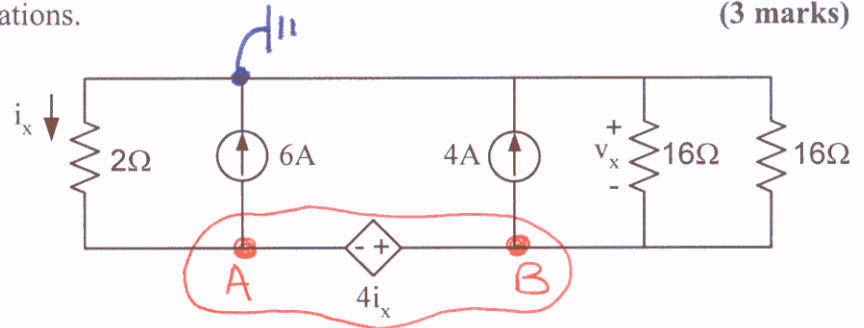
- Q#2 (a) Identify the nodes and write nodal equations  
 (b) Find  $v_x$  and  $i_x$  using nodal equations.

(5 marks)

(3 marks)

(a) Identify the nodes

Using supernode at nodes A, B.



$$\frac{V_A}{2} + 6 + 4 + \frac{V_B}{16} + \frac{V_B}{16} = 0$$

$$\Rightarrow 8V_A + 160 + 2V_B = 0 \Rightarrow 8V_A + 2V_B = -160 \quad \text{--- (1)}$$

One more equation is for dependent source.

$$V_B - V_A = 4i_x \quad \text{But } i_x = -\frac{V_A}{2}$$

$$\Rightarrow V_B - V_A = -2V_A \Rightarrow V_A + V_B = 0 \quad \text{--- (2)}$$

(b) Solve eq (1) & (2) simultaneously.

$$\text{(1)} \times 1 \Rightarrow 8V_A + 2V_B = -160$$

$$\text{(2)} \times 2 \Rightarrow \underline{-2V_A + 2V_B = 0}$$

$$6V_A = -160 \Rightarrow V_A = \frac{-80}{3} = -26.67$$

$$\therefore V_B = +\frac{80}{3} = +26.67$$

$$v_x = -V_B = -26.67 \text{ V}$$

$$i_x = -\frac{V_A}{2} = +13.34 \text{ A}$$

Q#3 (a) Write mesh equations for the following circuit. (5 marks)

(b) Find power of 2A and 10V sources. Indicate if the power is absorbed or delivered. (3 marks)

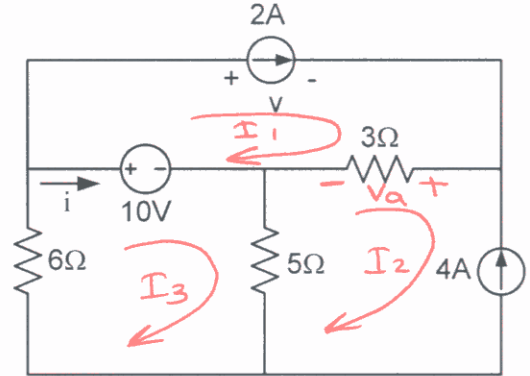
(a)  $I_1 = 2A$  ;  $I_2 = -4A$ .

KVL in mesh  $I_3$

$$+10 + 5(I_3 - I_2) + 6I_3 = 0$$

$$\Rightarrow 10 + 5(I_3 + 4) + 6I_3 = 0$$

$$\Rightarrow 11I_3 = -30 \Rightarrow I_3 = -\frac{30}{11} = -2.72A$$



(b) Apply KVL in loop  $I_1$

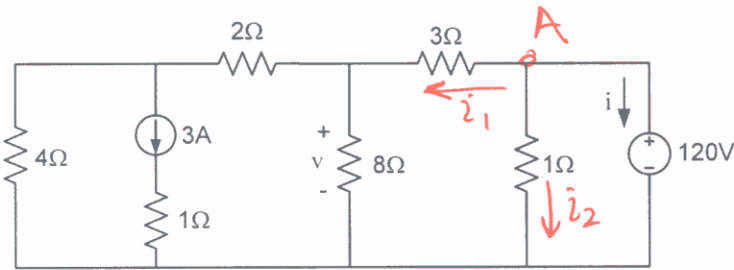
$$+V + V_a - 10 = 0 \Rightarrow V + 3(I_1 - I_2) - 10 = 0$$

$$\Rightarrow V = 10 - 3(2 + 4) \Rightarrow \boxed{V = -8V}$$

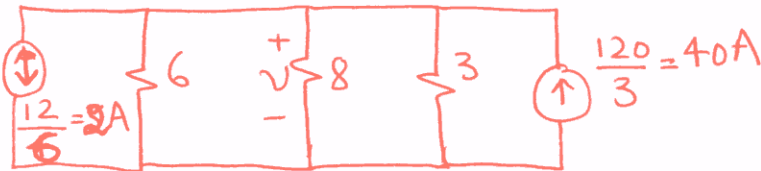
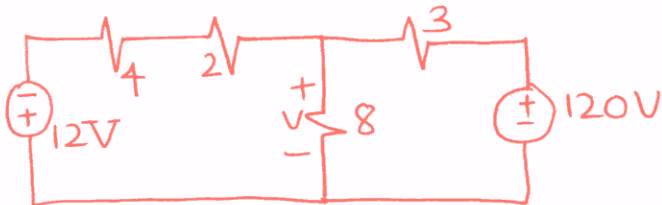
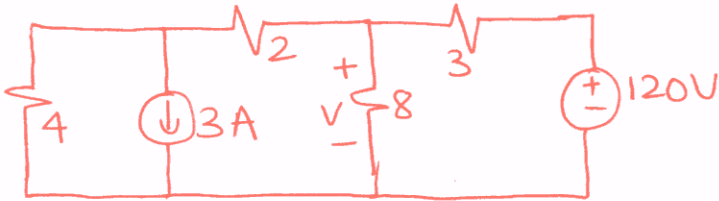
$$\therefore P_{2A} = + (2)(V) = -16W \text{ (delivered)}$$

$$P_{10V} = + (10)(i) = + (10)(I_3 - I_1)$$
$$= + (10)(-2.72 - 2) = -47.2W \text{ (delivered)}$$

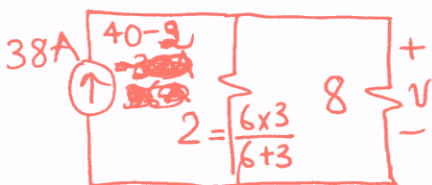
- Q#4 (a) Use source transformation to reduce the following circuit as much as possible and find  $v$  from the reduced circuit (4 marks)  
 (b) After finding  $v$  use the original circuit, given below, to find  $i$ . (2 marks)



(a) Resistance in series with current source & resistance in parallel with voltage source can be removed.



Combine two current source in parallel & 6 & 3Ω in parallel



$$v = \left[ \frac{2}{2+8} \times 38 \right] \times 8 = 60.8 \text{ V}$$

(b) From original circuit

$$i_1 = \frac{120 - v}{3} = \frac{120 - 60.8}{3}$$

$$i_1 = 19.73 \text{ A}$$

$$i_2 = \frac{120}{1} = 120 \text{ A}$$

Apply KCL at A.

$$i_1 + i_2 + i = 0$$

$$\Rightarrow i = -i_1 - i_2$$

$$\Rightarrow i = -139.73 \text{ A}$$