Q-1: Draw the circuit of Fig 1 in your answer script and mark down all the nodes.

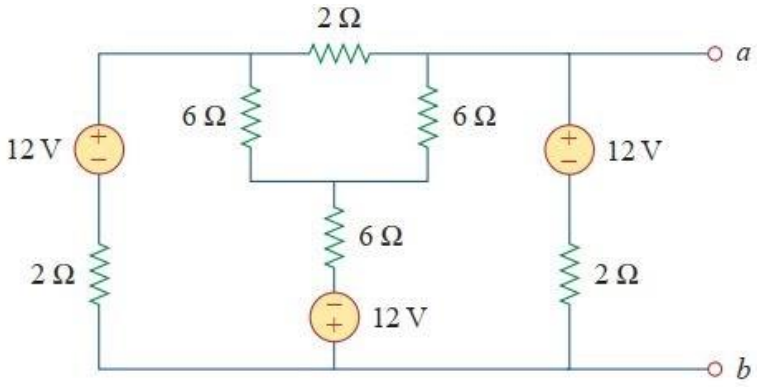
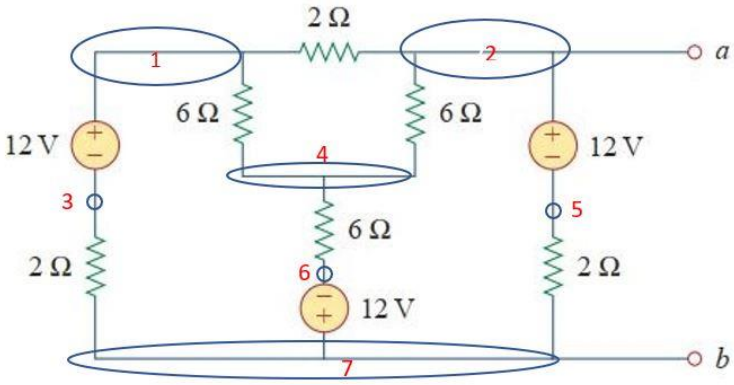
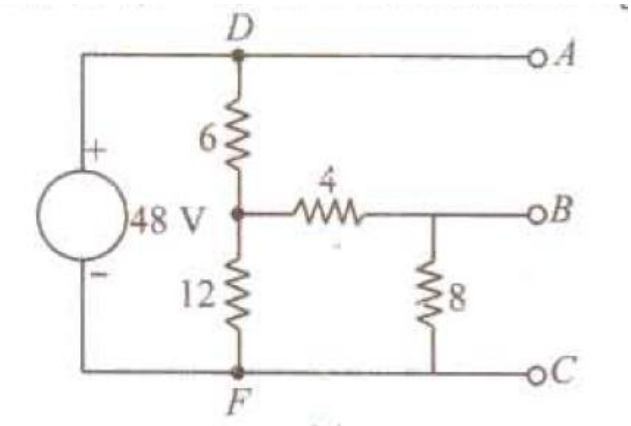


Fig 1

Ans:



Q-2: Calculate the value of V_{th} and R_{th} between terminals *B* and *C* of the circuit shown in Fig 2. All resistance values are in ohms.



Ans:

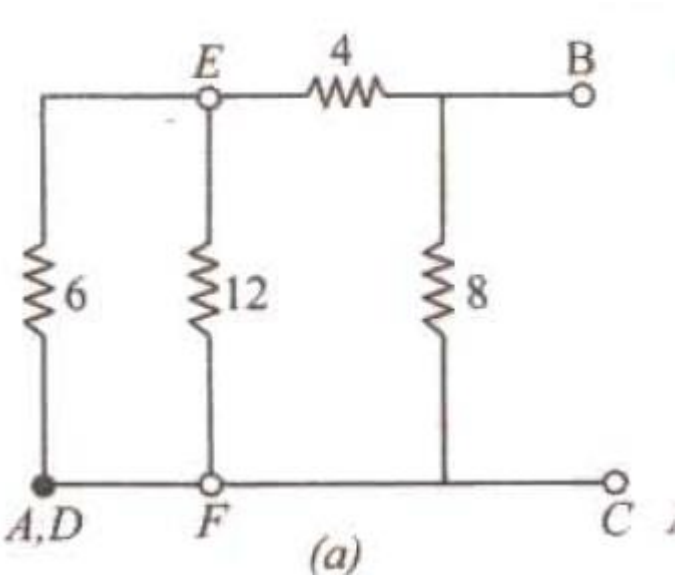
Vth:

R_{EF}= 12||(4+8)=6Ω

$V_{EF}=48 \times \frac{6}{6+6} = 24\ V$

VBC=$24 \times \frac{8}{4+8} = 16\ V$ (Ans)

Rth:



Rth = ((6||12)+4)||8= 4 Ω (Ans)

Q-3: Calculate V_0 of the following circuit (Fig 3) using nodal analysis.

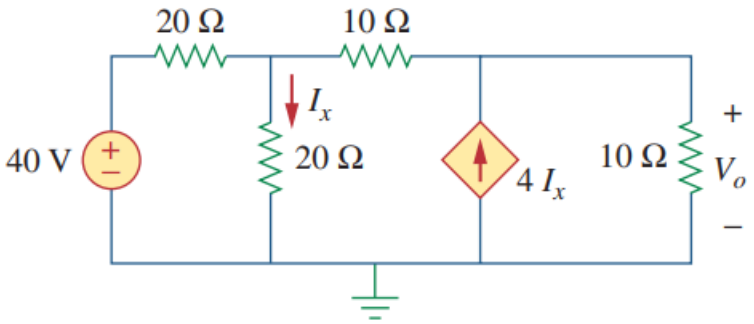
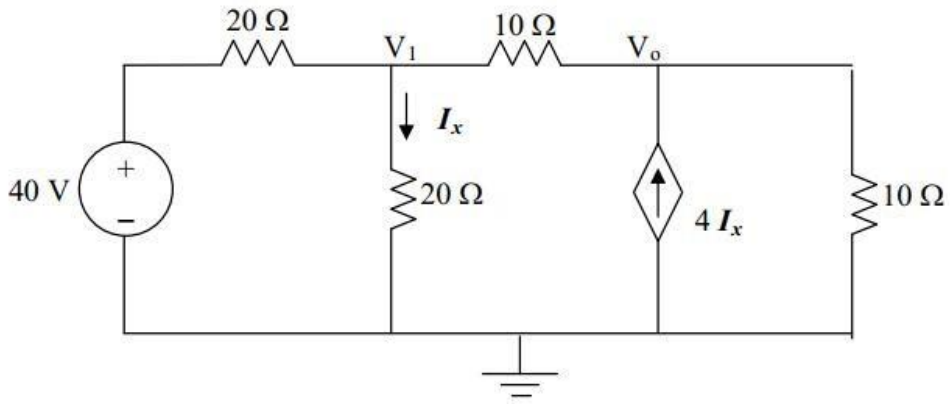


Fig 3

Ans:



At node 1,

$$\frac{V_1 - 40}{20} + \frac{V_1 - 0}{20} + \frac{V_1 - V_o}{10} = 0 \text{ or}$$

$$(0.05+0.05+.1)V_1 - 0.1V_o = 0.2V_1 - 0.1V_o = 2 \qquad (1)$$

At node o,

$$\frac{V_o - V_1}{10} - 4I_x + \frac{V_o - 0}{10} = 0 \text{ and } I_x = V_1/20$$

$$-0.1V_1 - 0.2V_1 + 0.2V_o = -0.3V_1 + 0.2V_o = 0 \text{ or} \qquad (2)$$

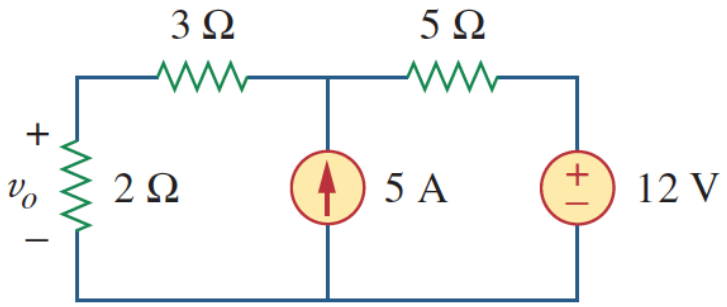
$$V_1 = (2/3)V_o \qquad (3)$$

Substituting (3) into (1),

$$0.2(2/3)V_o - 0.1V_o = 0.03333V_o = 2 \text{ or}$$

$$V_o = \mathbf{60\ V}.$$

Q-4: Using the superposition theorem, find Vo in the circuit of Fig. 4.



Ans:

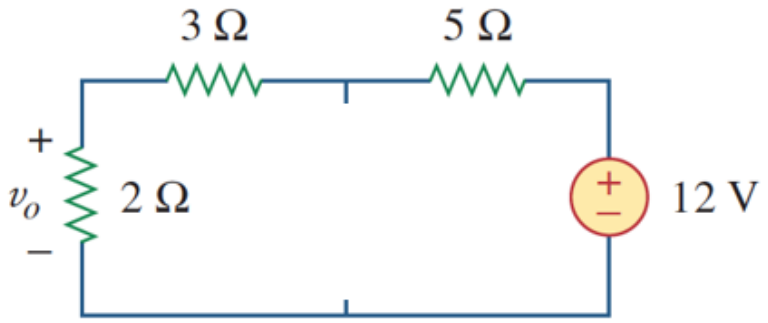
Since there are 2 sources, let,

$$V_0 = V_{01} + V_{02}$$

Where V_{01} and V_{02} are the contributions due to the 12V voltage source and the 5A current source, respectively.

When 12 V voltage source is active alone:

To obtain V_{01}, we set the current source to zero by replacing it by open circuit.



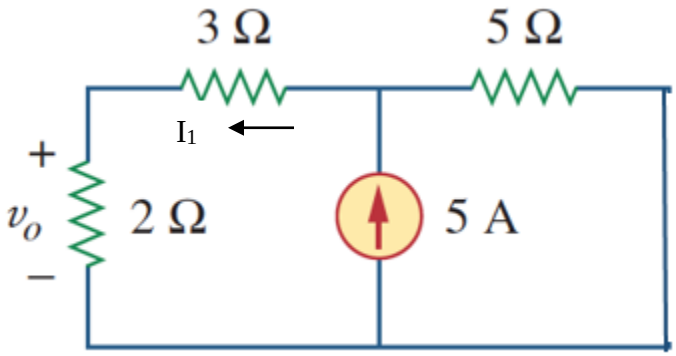
Applying Voltage divider rule,

$V_{01} = \frac{12*2}{2+(5+3)}$ V

$= \frac{24}{10} = 2.4$ V

When 5A current source is active alone:

To obtain V_{02}, we set the voltage source to zero by replacing it by short circuit.



Let, the current flowing through 2Ω resistor's branch is I_1. So, applying current divider rule,

$I_1 = \frac{5*5}{5+(3+2)}$ A

$= \frac{25}{10}$ A = 2.5 A

$V_{02} = (I_1 * 2\Omega) = (2.5*2)$ V = 5 V

So, $V_0 = V_{01} + V_{02}$

$= (2.4+5)$ V

= 7.4 V (Ans)

Q-5: Identify the value of I_1 and I_2 of the following circuit (Fig. 5)

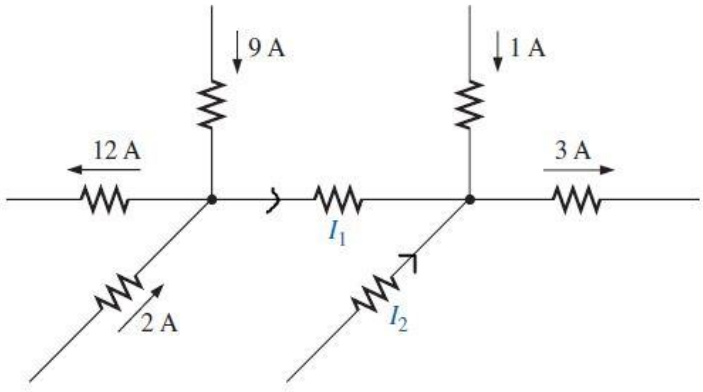


Fig : 5

Ans :

$12-9-2+I_1 = 0$

$I_1 = -1A$

$3-1+1-I_2 = 0$

$I_2 = 3$ A

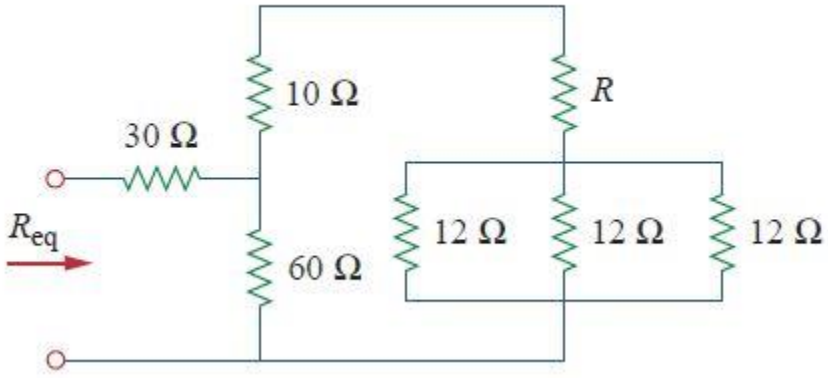
Q-6:

6. Read all the statements below and find the correct answers. You may select more than one option.
   [a] Ohm's law is applicable for all elements and all conditions.
   [b] Current can flow through an open circuit.

[c] Thevenin Theorem cannot be applied in circuits where the resistance of a component changes with voltage or current.
[d] In a circuit if all the resistance have equal value then $R_y < R_{del}$.

Ans: C and D both

Q-7: Suppose R_{eq} is equal to the last two digits of your student ID. Calculate the value of R from the following figure (Fig 6)



Suppose Req=50 Ω

Ans:

Let R_0 = combination of three 12Ω resistors in parallel

$$\frac{1}{R_o} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} \longrightarrow R_o = 4$$

$$R_{eq} = 30 + 60 \| (10 + R_0 + R) = 30 + 60 \| (14 + R)$$