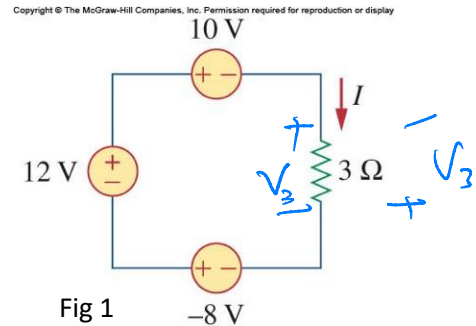


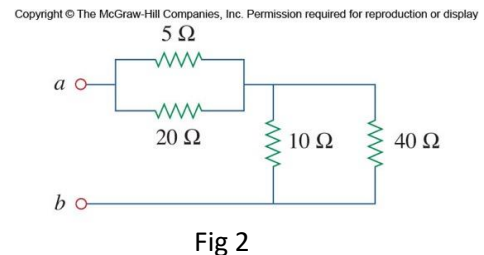
1) For the circuit in Fig 1, find (a) the voltage across $3\ \Omega$, (b) current I .

Hint: determine the net voltage across the $3\ \Omega$ resistor by the summing of all the three voltage sources. Then apply ohm's law to determine I .



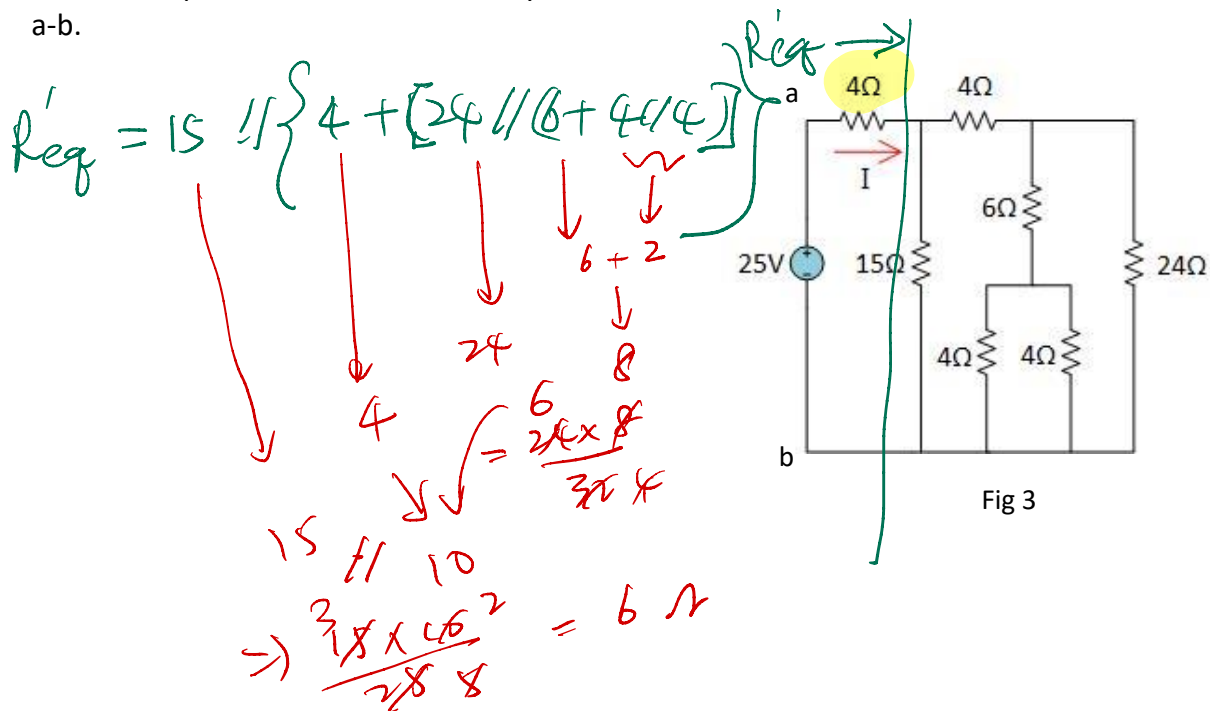
2) Calculate the equivalent resistance R_{ab} at terminals a-b for Fig 2.

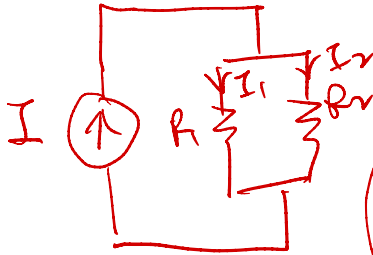
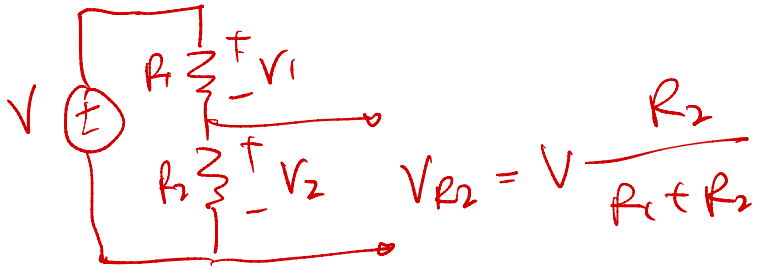
Hint: the total resistance is the sum of the parallel resistance of $5\ \Omega$ and $20\ \Omega$ plus the parallel resistance of $10\ \Omega$ and $40\ \Omega$.



3) For the circuit in Fig 3, find the current I . Hint: Find the equivalent resistance seen by the source, and use Ohm's law.

Hint: The equivalent resistance seen by the source means the total resistance across terminal a-b.





$$I_1 + I_2 = I$$

$$V = I_1 R_1 = I_2 R_2 \quad *$$

replace I_1 by I into (*)

$$I_1 = I - I_2$$

$$(I - I_2) R_1 = I_2 R_2$$

$$I R_1 - I_2 R_1 = I_2 R_2$$

$$I R_1 = I_2 (R_1 + R_2)$$

$$I_2 = I \frac{R_1}{R_1 + R_2}$$

if $R_1 > R_2$

$$I R_1 < I R_2$$

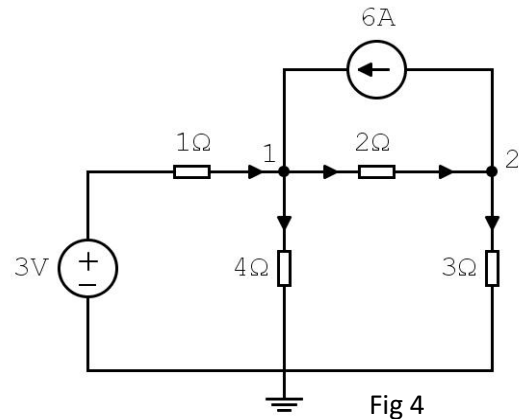
4) For the circuit in Fig 4, given the current directions at node 1 and node 2,

i) Circle the correct nodal equation at node 1.

- (a) $24 = -V_1 - 2V_2$
- (b) $18 = 7V_1 - 2V_2$
- (c) $12 = -V_1 - 2V_2$
- (d) $36 = 7V_1 - 2V_2$

ii) Circle the correct nodal equation at node 2.

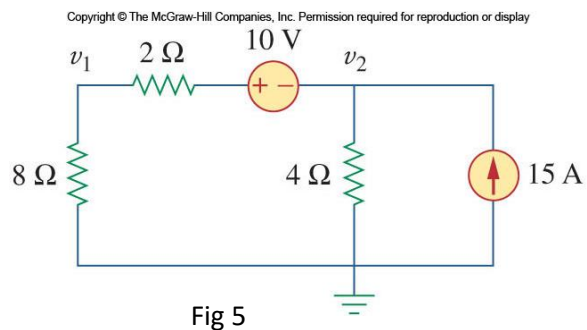
- (a) $3V_1 - 5V_2 = 36$
- (b) $3V_1 - V_2 = 36$
- (c) $3V_1 - 5V_2 = -36$
- (d) $3V_1 - V_2 = -36$



Hint on (i): assume all the current flowing into node 1 is positive, the summation of all current flowing along the 1Ω , 4Ω , 2Ω and $6A$ source should be zero by KCL.

5) By applying nodal analysis at node v_2 of circuit in Fig 5, find v_1 and v_2 .

Hint: the current through the $10V$ source is determine by ohm's law using 2Ω and 8Ω .



6) For the circuit in Fig 6, obtain the mesh equation at: (No need to solve for variables, you only need to determine the constants $a_1, \dots, b_1, \dots, c_1$.. in the following equations.)

Hint: Assume the voltage across the $4A$ current source is v

- i) Mesh 1 with final form: $a_1 \cdot i_1 + a_2 \cdot i_2 + a_3 \cdot i_3 = 8 - v$
- ii) Mesh 2 with final form: $c_1 \cdot i_1 + c_2 \cdot i_2 + c_3 \cdot i_3 = -v$
- iii) Mesh 3 with final form: $b_1 \cdot i_1 + b_2 \cdot i_2 + b_3 \cdot i_3 = 0$

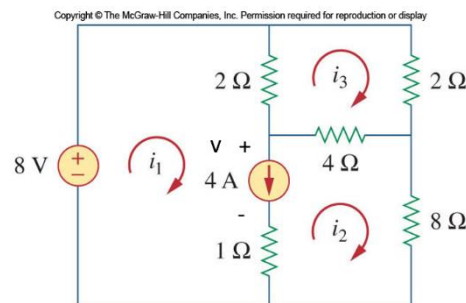
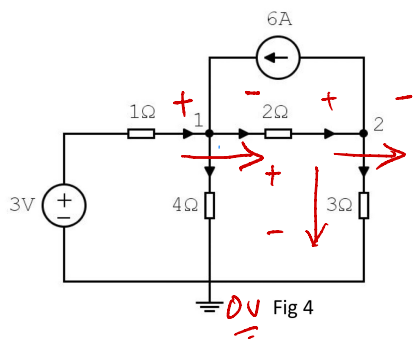


Fig 6



node 1, current towards a node
 $\Rightarrow$ +ve

KCL

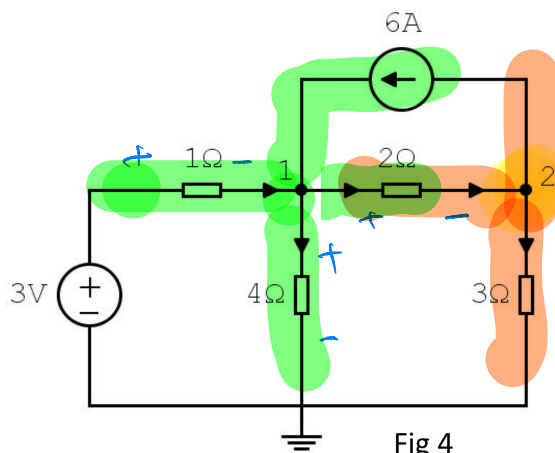
$$4 \left(\frac{3 - V_1}{1} - \frac{V_1 - 0}{4} - \frac{V_1 - V_2}{2} + 6 \right) = 0$$

$$12 - 4V_1 - V_1 - 2V_1 + 2V_2 + 24 = 0$$

$$36 - 7V_1 + 2V_2 = 0$$

$$36 - 7V_1 + 2V_2 = 0$$

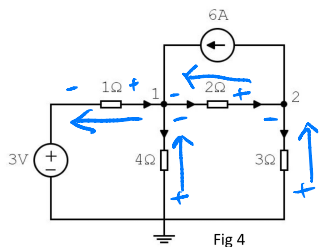
$$36 = 7V_1 - 2V_2$$



$$6\left(\frac{V_1 - V_2}{2} - \frac{V_2}{3} - 6\right) = 0$$

$$3V_1 - 3V_2 - 2V_2 - 36 = 0$$

$$36 = 3V_1 - 5V_2$$



KCL at node V_1
current towards the
node is +ve.

$$4 \left[-\left(\frac{V_1 - 3}{1}\right) + \left(\frac{0 - V_1}{4}\right) + \left(\frac{V_2 - V_1}{2}\right) + 6 \right] = 0$$

$$-4V_1 + 12 + 0 - V_1 + 2V_2 - 2V_1 + 24 = 0$$

$$12 + 24 - 4V_1 - V_1 - 2V_1 + 2V_2 = 0$$

$$36 - 7V_1 + 2V_2 = 0$$

$$36 = 7V_1 - 2V_2$$