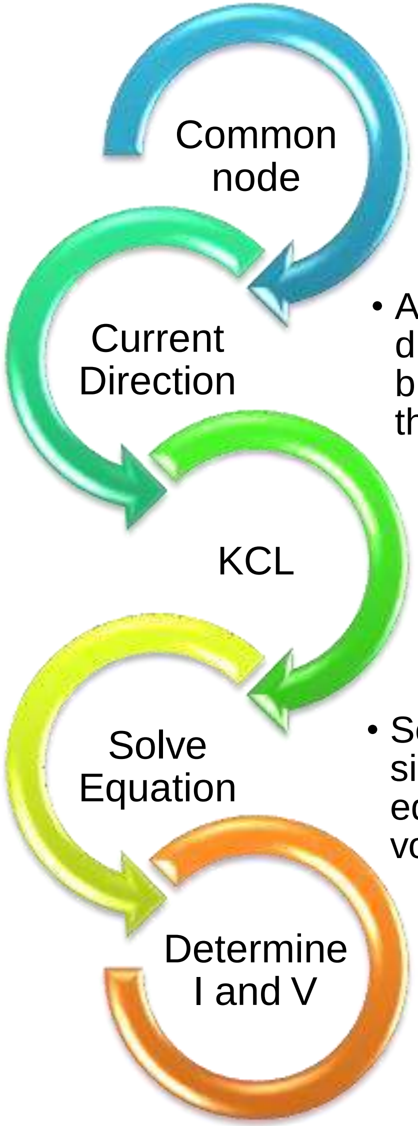
NODES ANALYSIS

Analysis using KCL to solve for voltages at each common node of the network and hence determine the currents though and voltages across each elements of the network.

Nodes Analysis Procedure

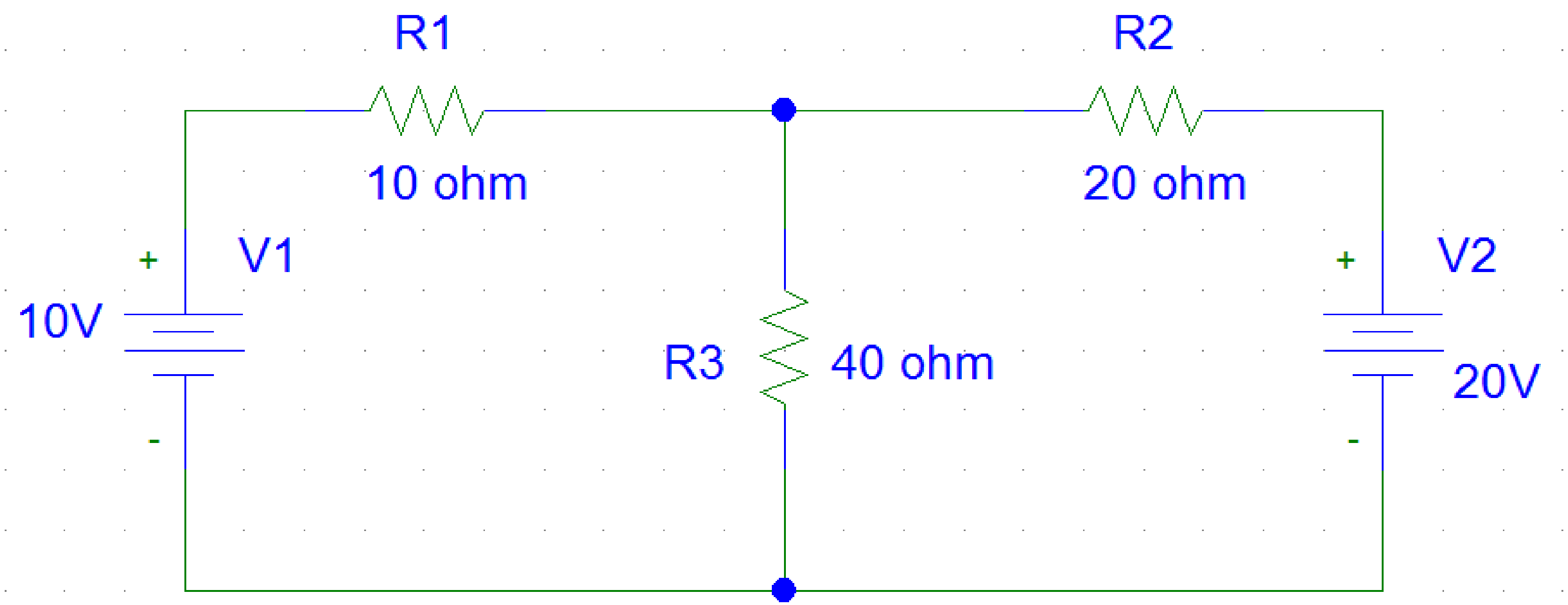


- Determine the number of common nodes and reference node within the network
- Assign current and its direction to each distinct branch of the nodes in the network
- Apply KCL at each of the common nodes in the network
- Solve the resulting simultaneous linear equation for the node voltage
- Determine the currents through and voltages across each elements in the network

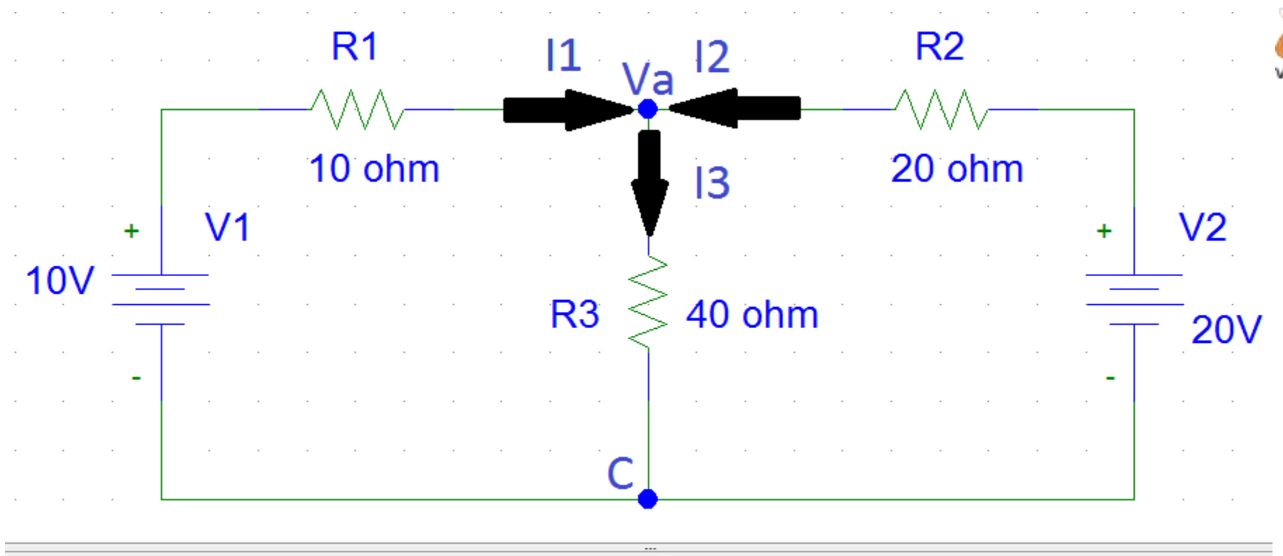
EXERCISE

Example 1:

Find the current flow through each resistor using node analysis for the circuit below.



EXERCISE



REMEMBER THE STEPS EARLIER??

Determine the number of common nodes and reference node within the network.

1 common node (Va) and 1 reference node C

Assign current and its direction to each distinct branch of the nodes in the network (refer o the figure)

Apply KCL at each of the common nodes in the network

KCL: I1 + I2 = I3

$$\frac{(10-Va)}{10}+\frac{(20-Va)}{20}=\frac{Va}{40}$$

$$1-\frac{Va}{10}+1-\frac{Va}{20}=\frac{Va}{40}$$

$$\frac{Va}{40}+\frac{Va}{10}+\frac{Va}{20}=2$$

$$Va\left(\frac{1}{40}+\frac{1}{10}+\frac{1}{20}\right)=2$$

$$Va\left(\frac{7}{40}\right)=2$$

$$Va = 11.428V$$

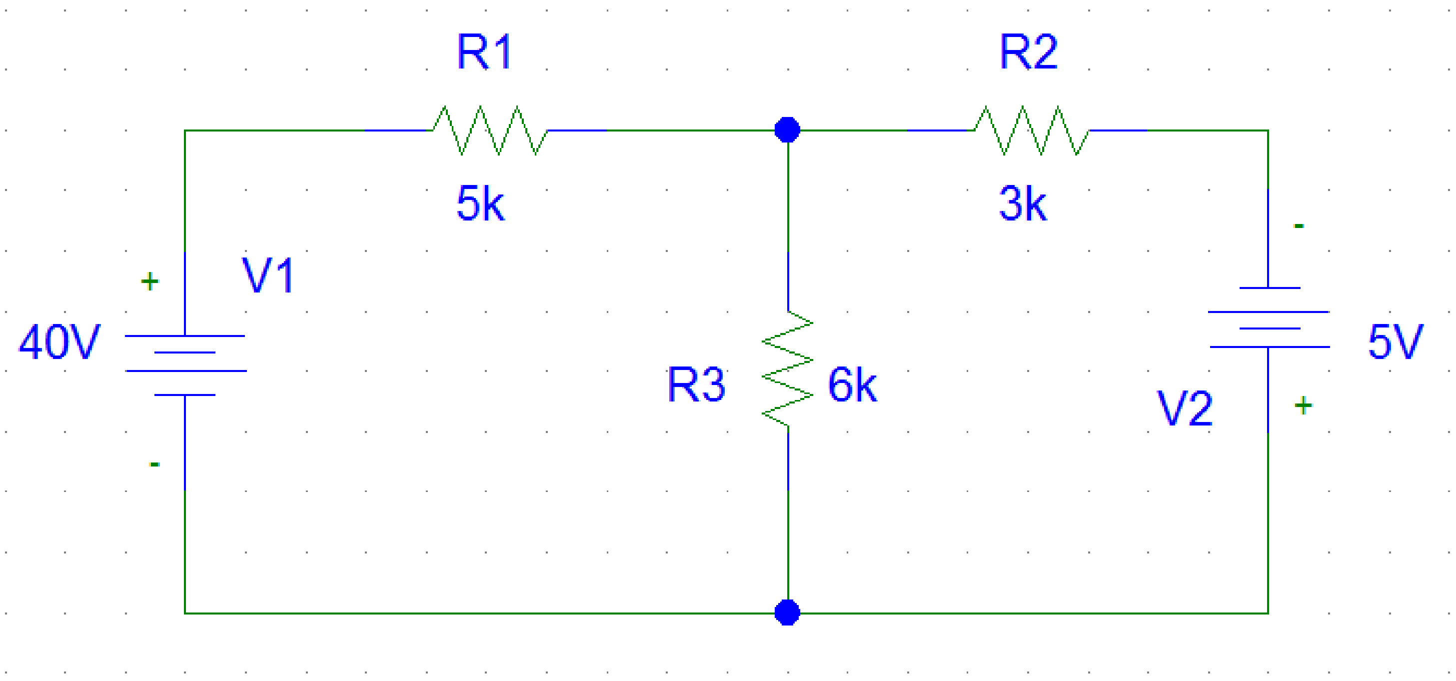
$$I_1=\frac{(10-11.428)}{10}=-0.143A$$

$$I_2=\frac{(20-11.428)}{20}=0.429A$$

$$I_3=\frac{11.428}{40}=0.286V$$

Example 2:

Find the current flow through each resistor using node analysis for the circuit below.



$$\frac{(40-Va)}{5k} = \frac{(Va-(-55))}{3k} + \frac{Va}{6k}$$

$$\frac{40}{6k} - \frac{Va}{6k} = \frac{Va}{3k} + \frac{55}{3k} + \frac{Va}{6k}$$

$$\frac{(-Va)}{5k} - \frac{Va}{3k} - \frac{Va}{6k} = \frac{55}{3k} - \frac{40}{5k}$$

$$-Va\left(\frac{1}{5k} + \frac{1}{3k} + \frac{1}{6k}\right) = \frac{55}{3k} - \frac{40}{5k}$$

$$-Va\,(700 \times 10^{-6}) = 10.33 \times 10^{-3}$$

$$Va = -14.757V$$

$$I_1 = \frac{(40-(-14.757))}{5k} = 10.95mA$$

$$I_2 = \frac{(-14.757+55)}{3k} = 13.41mA$$

$$I_3 = \frac{(-14.757)}{6k} = -2.46mA$$