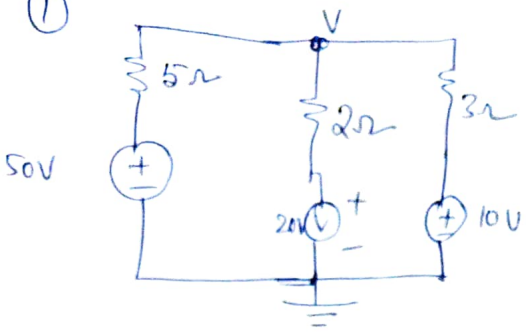
Nodal Analysis – PPT Solutions

$$I = \frac{V_1 - V_2}{R}$$

(1)



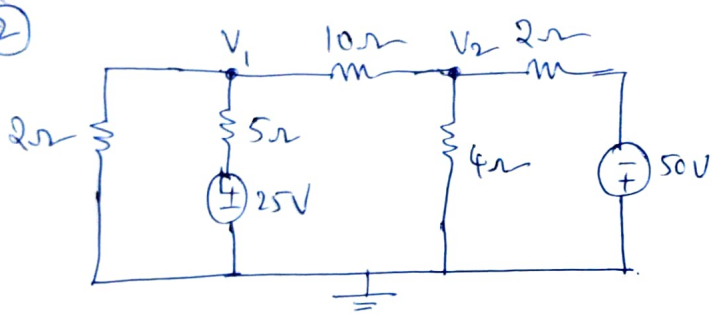
$$\frac{V-50}{5} + \frac{V-20}{2} + \frac{V-10}{3} = 0$$

$$\frac{6V - 300 + 15V - 300 + 10V - 100}{30} = 0$$

$$31V - 700 = 0$$

$$V = \frac{700}{31} = 22.58 \text{ volts.}$$

(2)



$$\frac{V_1 - 0}{2} + \frac{V_1 - 25}{5} + \frac{V_1 - V_2}{10} = 0$$

$$\frac{5V_1 - 0 + 2V_1 - 50 + V_1 - V_2}{10} = 0$$

$$8V_1 - V_2 - 50 = 0$$

$$8V_1 - V_2 = 50 \quad \text{—— (1)}$$

$$\frac{V_2 - V_1}{10} + \frac{V_2 - 0}{4} + \frac{V_2 + 50}{2} = 0$$

$$\frac{2V_2 - 2V_1 + 5V_2 + 10V_2 + 500}{20} = 0$$

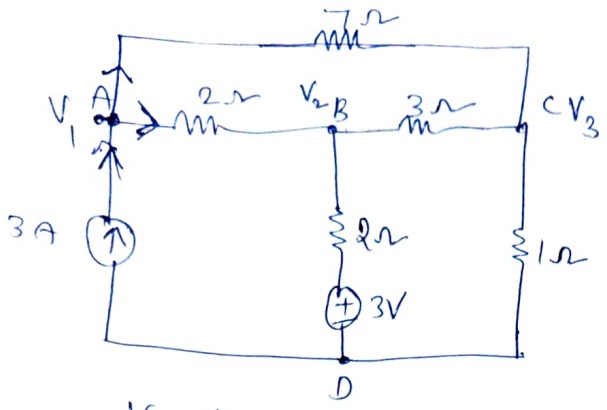
$$-2V_1 + 17V_2 = -500 \quad \text{—— (2)}$$

Solve eq (1) & (2) for V_1 & V_2 Values.

$V_1 = 2.62$ Volts

$V_2 = -29.1$ Volts.

③



$$\frac{V_1 - V_2}{2} + \frac{V_1 - V_3}{7} = 3$$

$$\frac{7V_1 - 7V_2 + 2V_1 - 2V_3}{14} = 3$$

$$9V_1 - 7V_2 - 2V_3 = 42 \quad \text{— (1)}$$

$$\frac{V_2 - V_3}{3} + \frac{V_2 - V_1}{2} + \frac{V_2 - 3}{2} = 0$$

$$\frac{2V_2 - 2V_3 + 3V_2 - 3V_1 + 3V_2 - 9}{6} = 0$$

$$-3V_1 + 8V_2 - 2V_3 = 9 \quad \text{— (2)}$$

$$\frac{V_3 - V_1}{7} + \frac{V_3 - V_2}{3} + \frac{V_3 - 0}{1} = 0$$

$$\frac{3V_3 - 3V_1 + 7V_3 - 7V_2 + 21V_3}{21} = 0$$

$$-3V_1 - 7V_2 + 31V_3 = 0 \quad \text{— (3)}$$

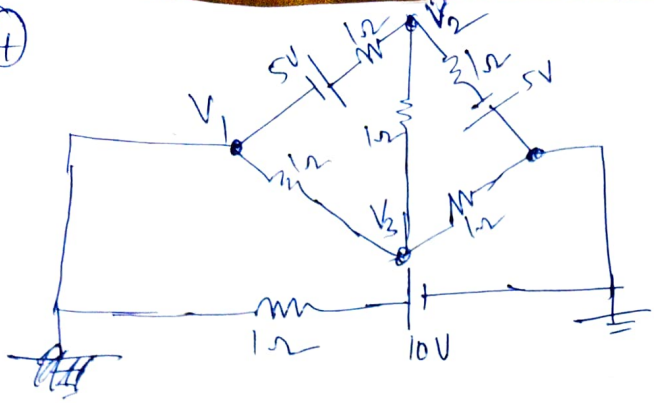
Solve for V_1, V_2 & V_3

$V_1 = 9$ Volts

$V_2 = 5$ Volts

$V_3 = 2$ Volts.

(4)



$$\frac{V_1 - 10}{1} + \frac{V_1 - V_3}{1} + \frac{V_1 + 5 - V_2}{1} = 0$$

$$3V_1 - V_2 - V_3 = 5 \quad \text{— (1)}$$

$$\frac{V_2 - 5 - V_1}{1} + \frac{V_2 - V_3}{1} + \frac{V_2 + 5 - 0}{1} = 0$$

$$-V_1 + 3V_2 - V_3 = 0 \quad \text{— (2)}$$

$$\frac{V_3 - V_1}{1} + \frac{V_3 - V_2}{1} + \frac{V_3 - 0}{1} = 0$$

$$-V_1 - V_2 + 3V_3 = 0 \quad \text{— (3)}$$

Solve for V_1, V_2 & V_3

$V_1 = 2.5$ Volts

$V_2 = 1.25$ Volts

$V_3 = 1.25$ Volts

$$I_1 = \frac{V_1 - V_3}{1} = \frac{2.5 - 1.25}{1} = 1.25 \text{ Amp.}$$

$$I_2 = \frac{V_1 - V_2 + 5}{1} = 2.5 - 1.25 + 5 = 6.25 \text{ Amp}$$

$$I_3 = \frac{V_2 - V_3}{1} = \frac{1.25 - 1.25}{1} = 0 \text{ Amp}$$

$$I_4 = \frac{V_2 - 0 + 5}{1} = \frac{1.25 + 5}{1} = \frac{6.25}{1} = 6.25 \text{ Amp.}$$

$$I_5 = \frac{V_2 - 0}{1} = 1.25 \text{ Amp.}$$

$I = I_1 + I_2$

$= 7.5$ Amp