Series and parallel resistors :

Series :

$$R = R_1 + R_2 + \ldots + R_N \quad \Rightarrow R_s = \sum_{k=1}^{N} R_k$$

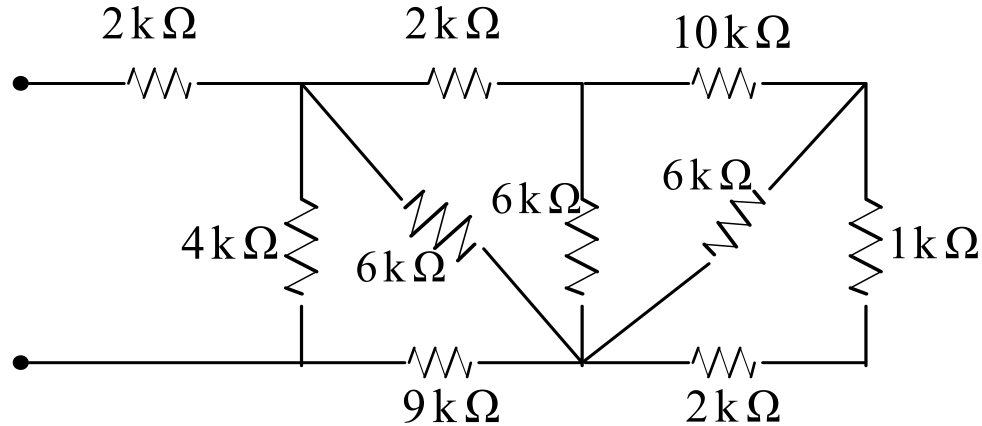
Parallel

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_N}$$

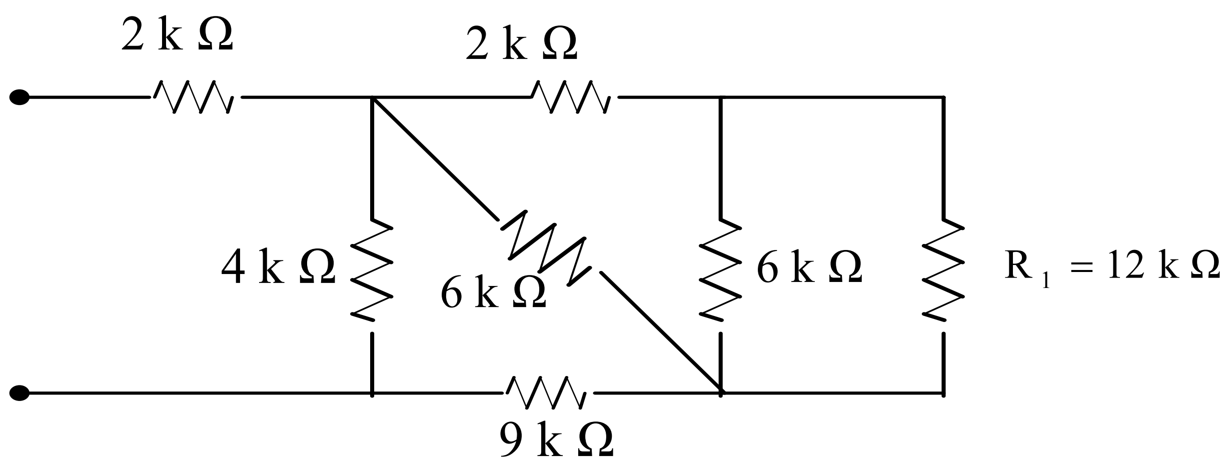
$$\frac{1}{R_P} = \sum_{k=1}^{N} \frac{1}{R_k}$$

Example :

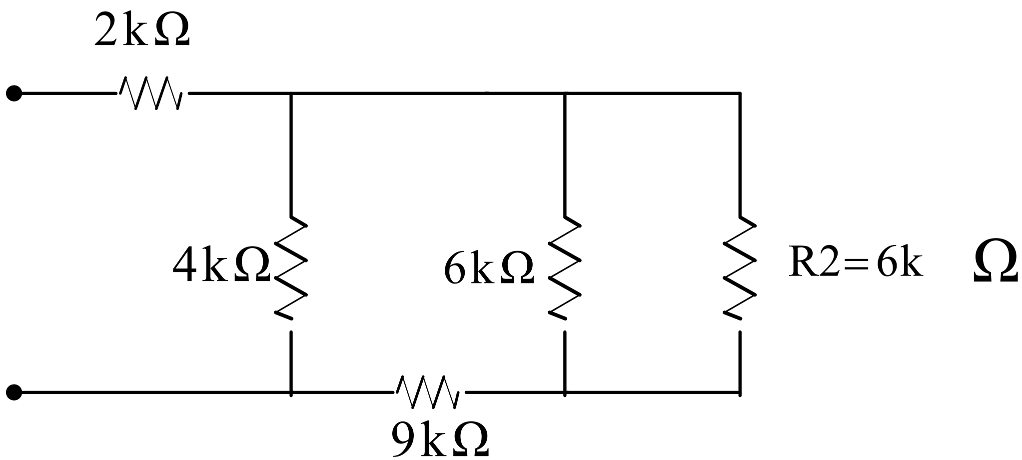
Find equivalent resistance



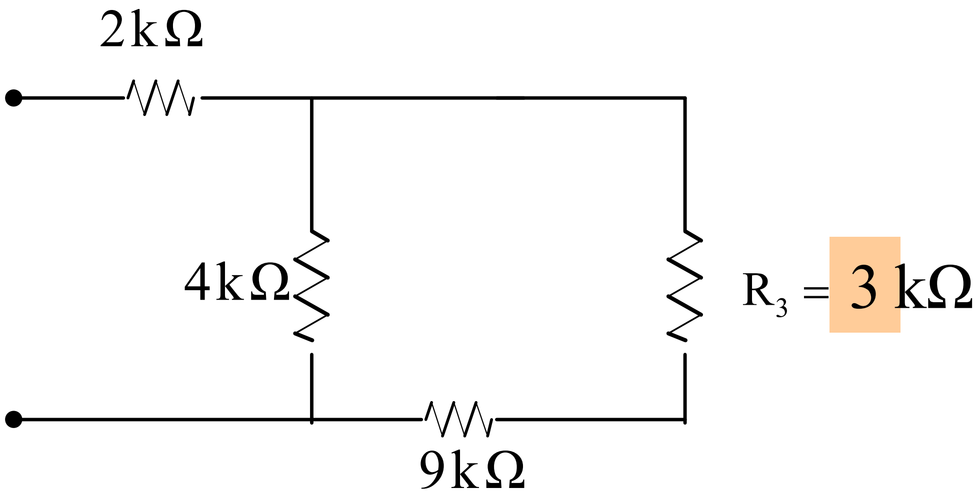
$$R_1 = \{[(1\,k\Omega) + (2\,k\Omega)] \,||\, 6k\Omega\} + 10\,k\Omega$$



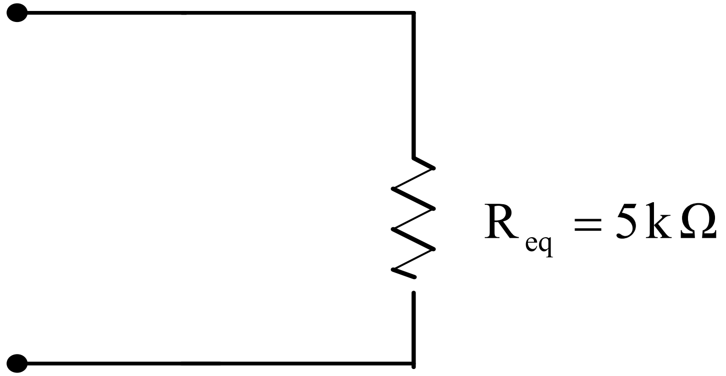
$$R2 = [12\,k \,//\, 6\,k] + 2\,k = 6k$$



$$R_3 = (6\,k \,//\, 6\,k) = 3k \quad \Omega$$

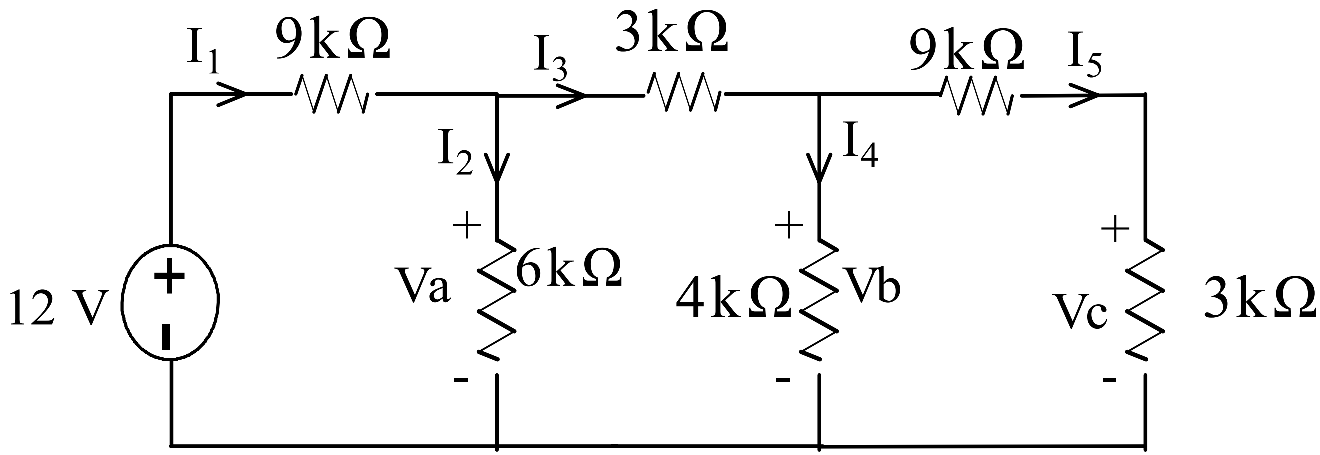


$$R_{eq} = (12k \,||\, 4k) + 2k = 5k$$

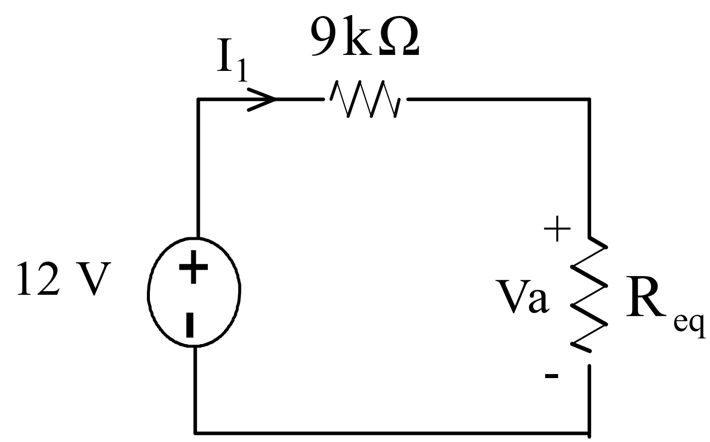


Example :

Find all currents and voltages



The equivalent circuit is :



$$R_{eq} = [[(3k + 9k) // 4k] + 3k] // 6k$$

$$= 3k\Omega$$

$$I_1 = \frac{12V}{9k + 3k} = 1mA \qquad \Rightarrow V_a = R_{eq}\, I_i = 3V$$

$$\therefore \quad I_2 = \frac{V_a}{6k\Omega} = \frac{3}{6k} = \frac{1}{2} mA$$

$$I_3 = I_1 - I_2 \qquad \Rightarrow I_3 = 1mA - \frac{1}{2} mA = \frac{1}{2} mA$$