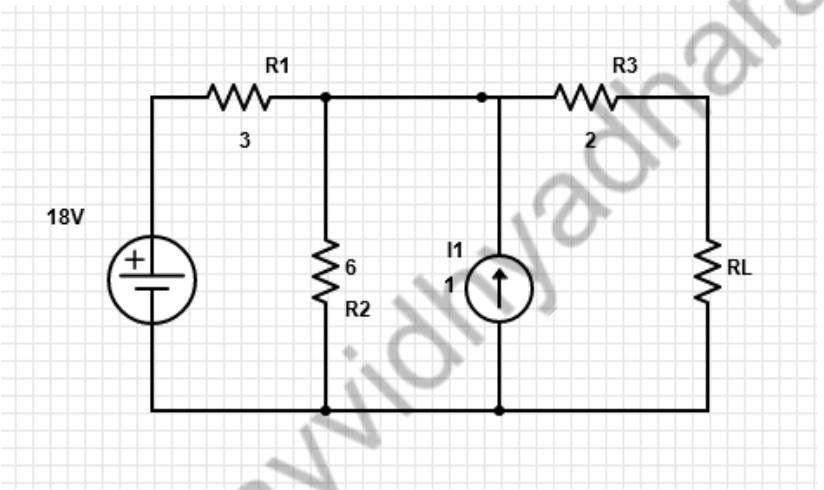
Electrical Science: 2021-22
Tutorial 3
Thevenin's, Norton's, Max-Power Transform and Superposition Theorem

By Dr. Sanjay Vidhyadharan

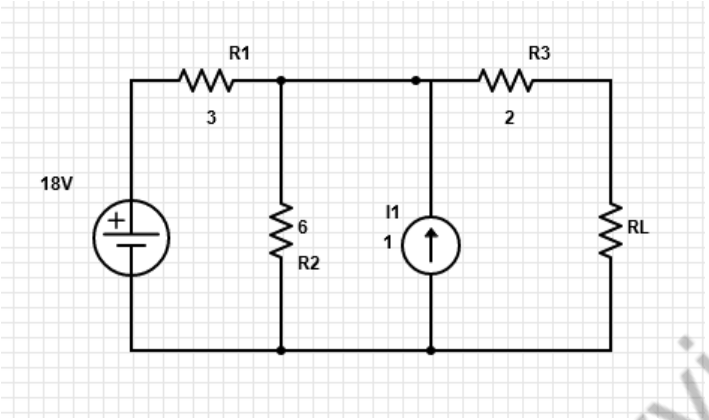
Problem 1

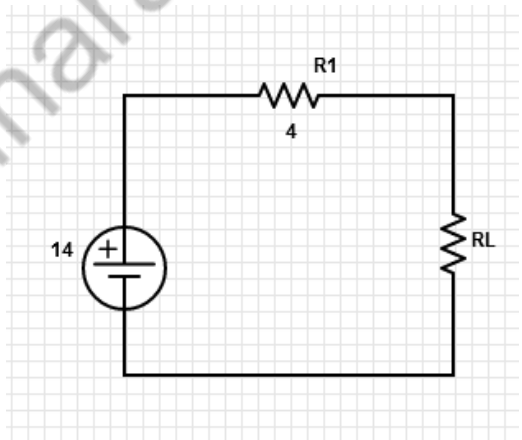
Find the Thevenin equivalent resistance and Voltage



Problem 1

Find the Thevenin equivalent resistance and Voltage



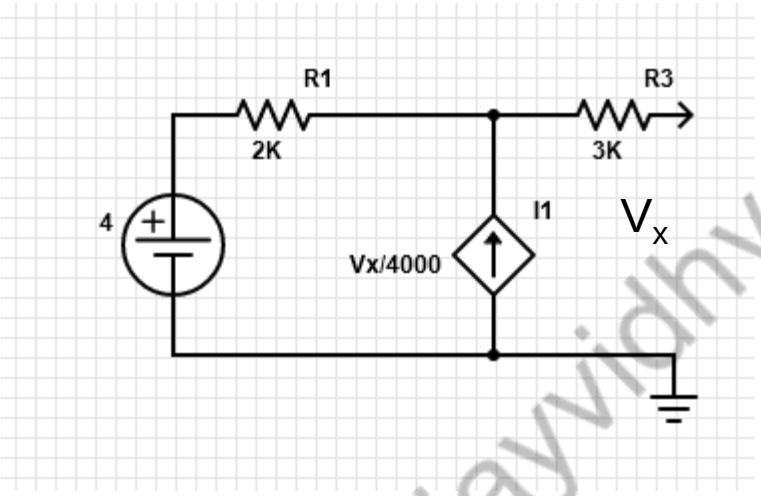


$$V_{Th} = \frac{18 * 6}{3 + 6} + \frac{1(6 * 3)}{6 + 3} = 14\ V$$

$$R_{Th} = \frac{3 * 6}{3 + 6} + 2 = 4\ Ohms$$

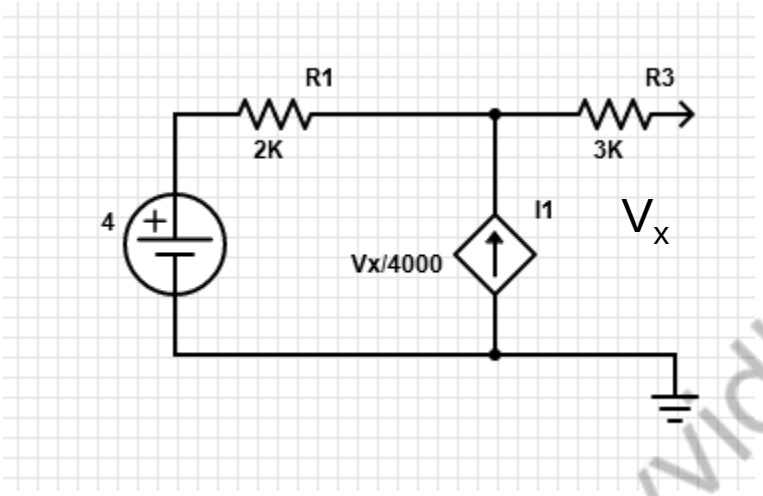
Problem 2

Find the Thevenin equivalent resistance and Voltage



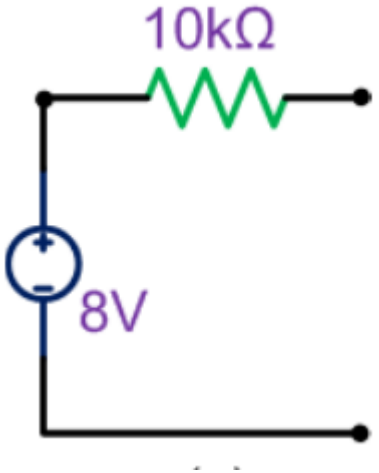
Problem 2

Find the Thevenin equivalent resistance and Voltage



$$I_{sc} = \frac{4}{5K} \text{ Amp}$$

$$R_{Th} = \frac{V_{Th}}{I_{sc}} = 10K$$

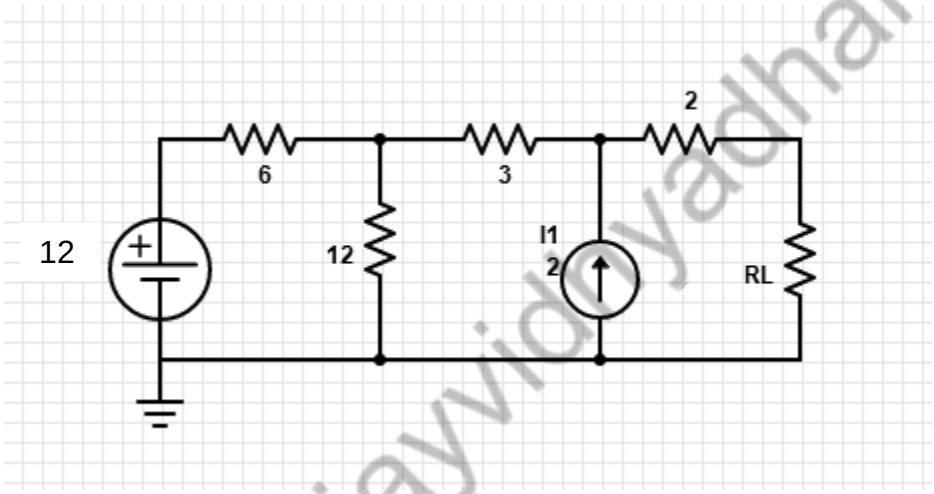


$$4 = \frac{-2000 * V_x}{4000} + V_x = 0.5\, V_x$$

$$V_{Th} = V_x = 8\, V$$

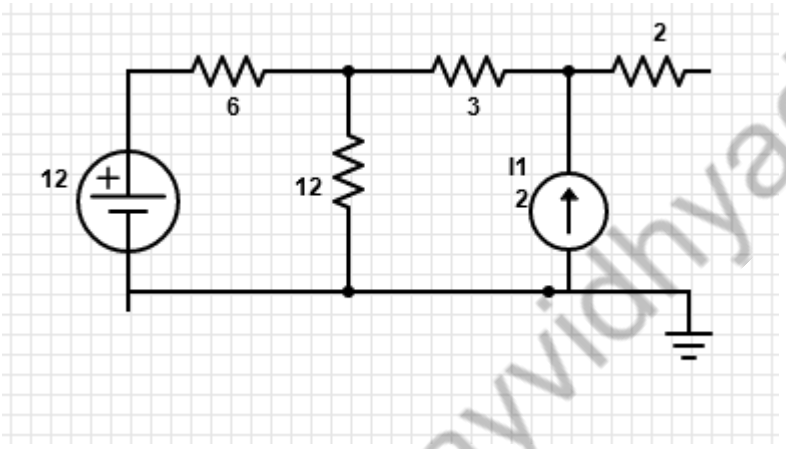
Problem 3

Find the value of for maximum power transfer in the circuit of the shown figure. Find the maximum power.



Problem 3

Find the value of for maximum power transfer in the circuit of the shown figure. Find the maximum power.



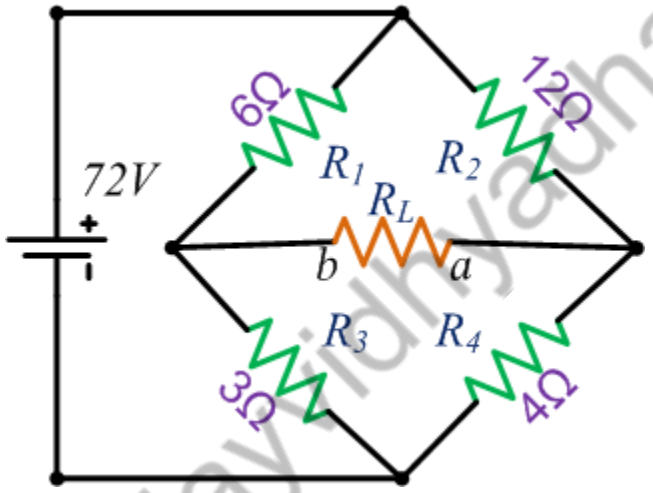
$$R_{Th} = 5 + \frac{6*12}{18} = 9 \text{ Ohms}$$

$$V_{Th} = \frac{12 * 12}{18} + 2 * 7 \ = 22\ V$$

$$p_{max} = \frac{22^2}{4\times9} = 13.44\text{W}$$

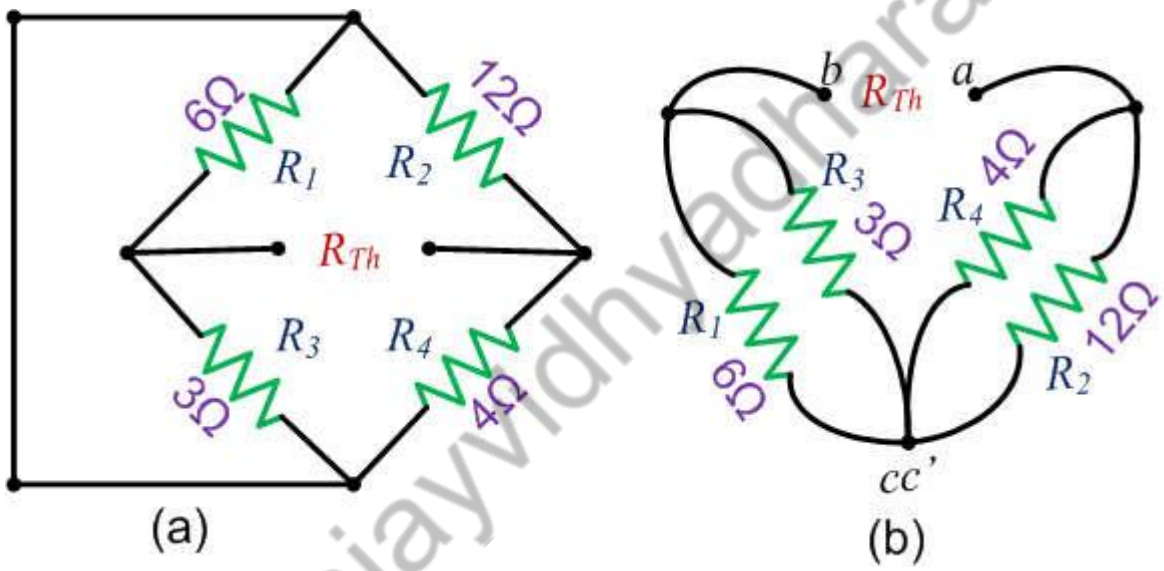
Problem 4

Find the Thevenin equivalent circuit of the circuit in shown figure at terminals a-b



Problem 4

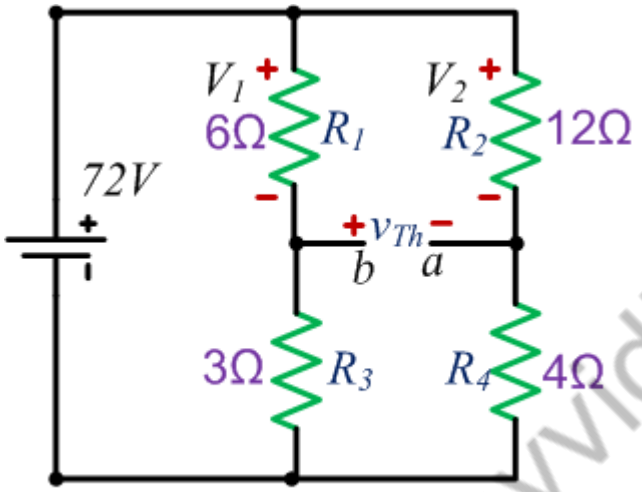
Find the Thevenin equivalent circuit of the circuit in shown figure at terminals a-b



$$R_{Th}=R_1//R_2+R_2//R_4$$
$$=6\Omega//3\Omega+4\Omega//\Omega12$$
$$=2\Omega+3\Omega=5\Omega$$

Problem 4

Find the Thevenin equivalent circuit of the circuit in shown figure at terminals a-b



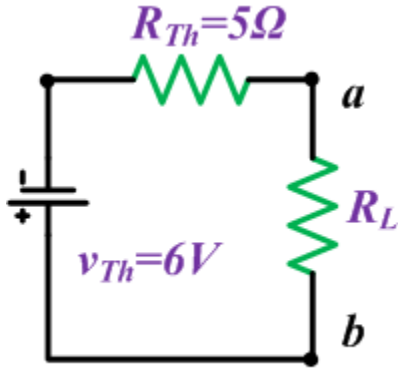
(c)

$$V_1 = \frac{R_1 E}{R_1 + R_3} = \frac{6 \times 72}{6+3} = \frac{432}{9} = 48\ V$$

$$V_1 = \frac{R_2 E}{R_2 + R_4} = \frac{12 \times 72}{12+4} = \frac{864}{16} = 54\ V$$

applying KVL to the top loop

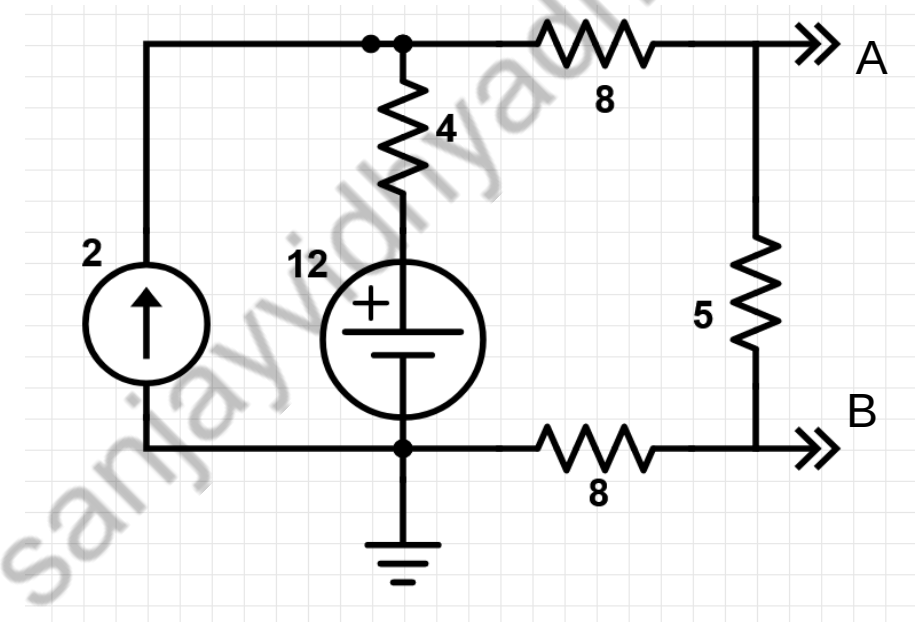
$v_{Th} = V_2 - V_1 = 54 - 48 = 6V$



(d)

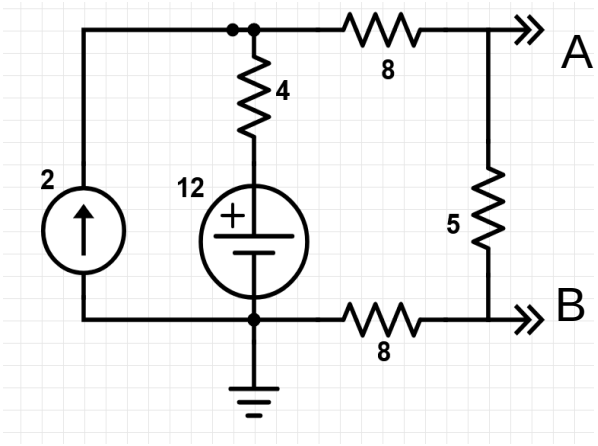
Problem 5

Find the Norton equivalent circuit of the circuit in shown figure at terminals A-B

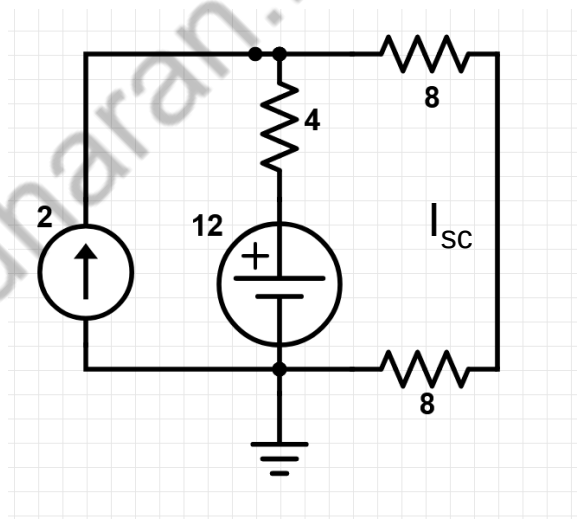


Problem 5

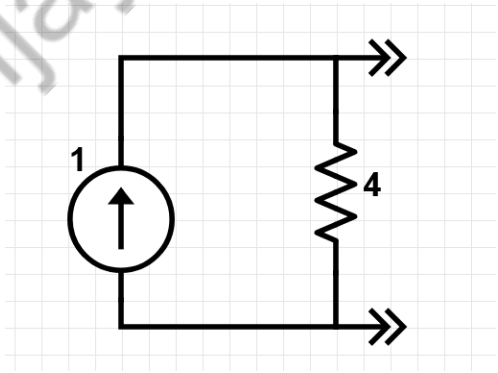
Find the Norton equivalent circuit of the circuit in shown figure at terminals A-B



$$R_{Th} = \frac{5 * 20}{5 + 20} = 4\ Ohms$$

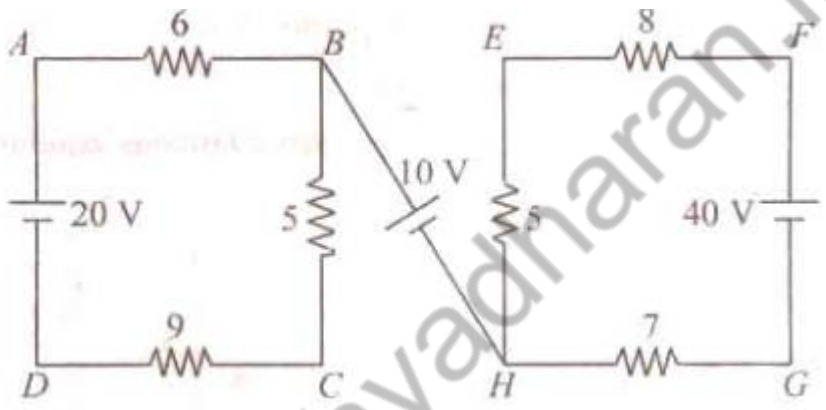


$$I_{SC} = \frac{12}{20} + \frac{2 * 4}{20} = 1\ A$$



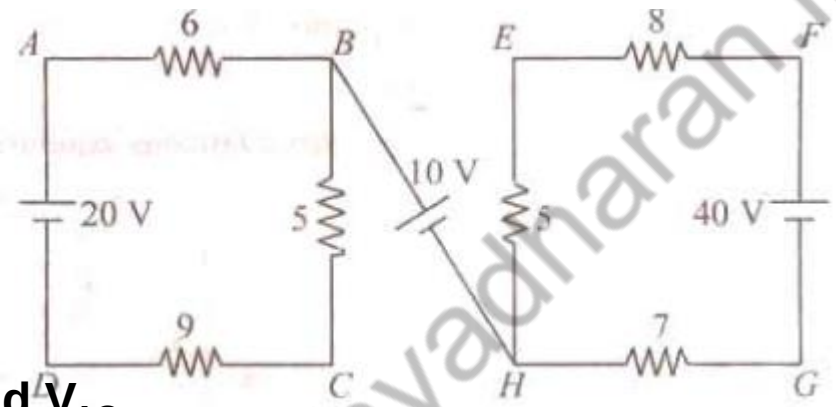
Problem 6

Find V_{CE} and V_{AG}



Problem 6

Find V_{CE} and V_{AG}



and V_{AG}

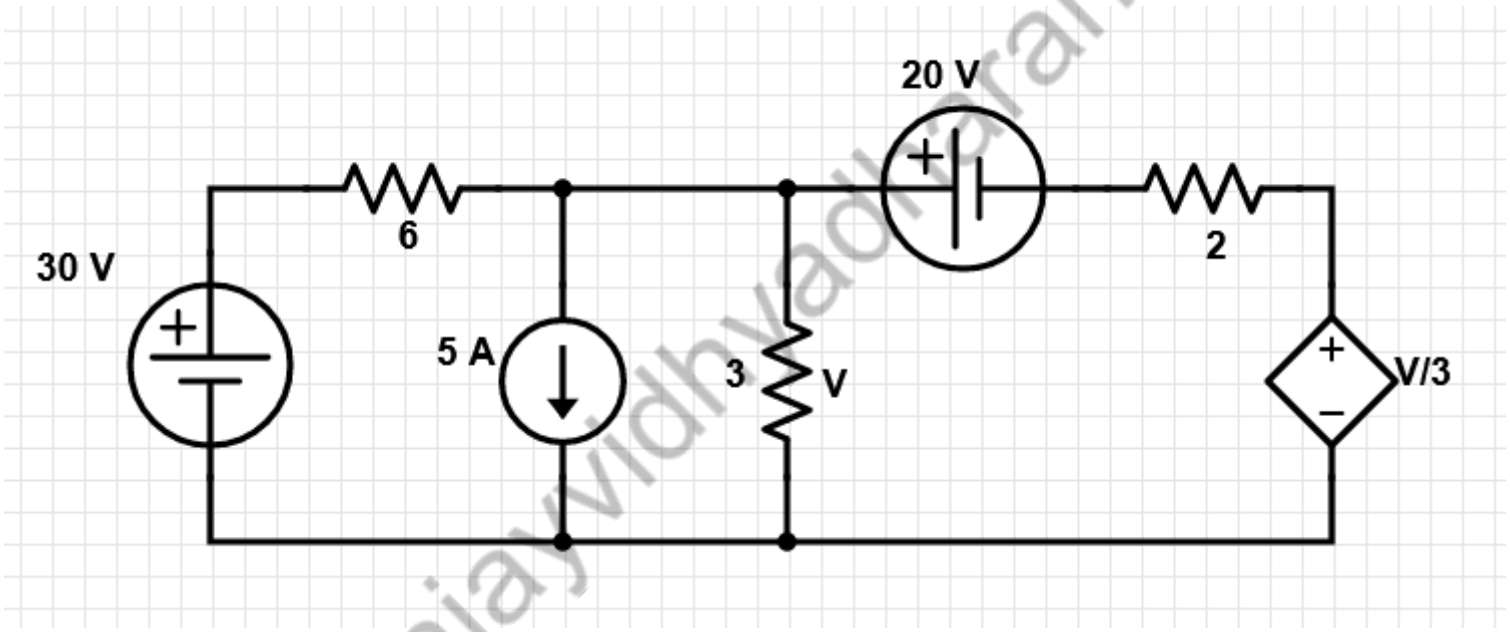
$$I_1 = \frac{20}{6+5+9} = 1 \qquad I_2 = \frac{40}{8+5+7} = 2$$

$$V_{CE} = -1 * 5 + 10 - 2 * 5 = -5\,V$$

$$V_{CE} = 1 * 6 + 10 + 2 * 7 = 30\,V$$

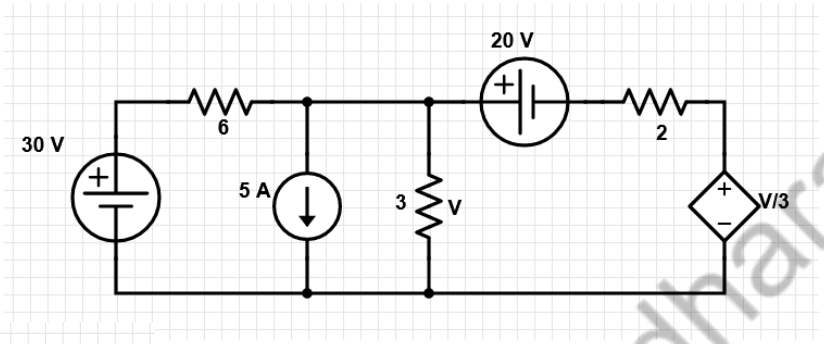
Problem 7

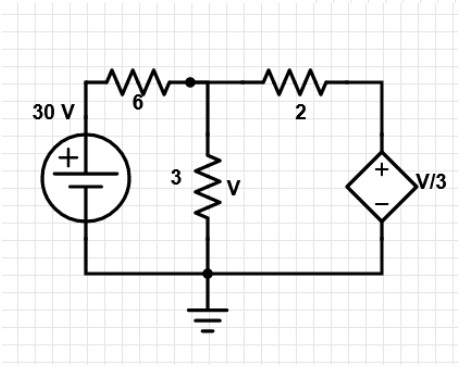
Find V



Problem 7

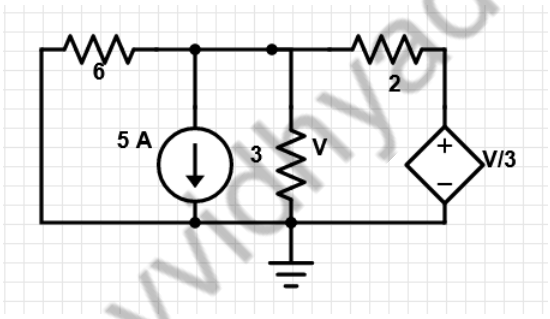
Find V





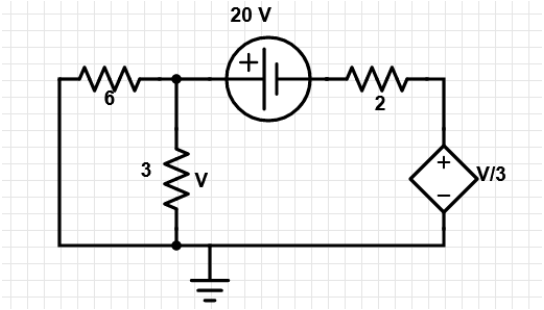
$$\frac{30-v}{6}-\frac{v}{3}+\frac{(\frac{v}{3}-v)}{2}=0$$

v = 6 V



$$\frac{-v}{6}-5-\frac{v}{3}+\frac{(\frac{v}{3}-v)}{2}=0$$

v = -6 V



$$20+\frac{v}{3}=i(2+2)$$

$$20+\frac{i*2}{3}=i(2+2)$$

i = 6 A v = 12 V

V = 6-6+12= 6 V

Thank you