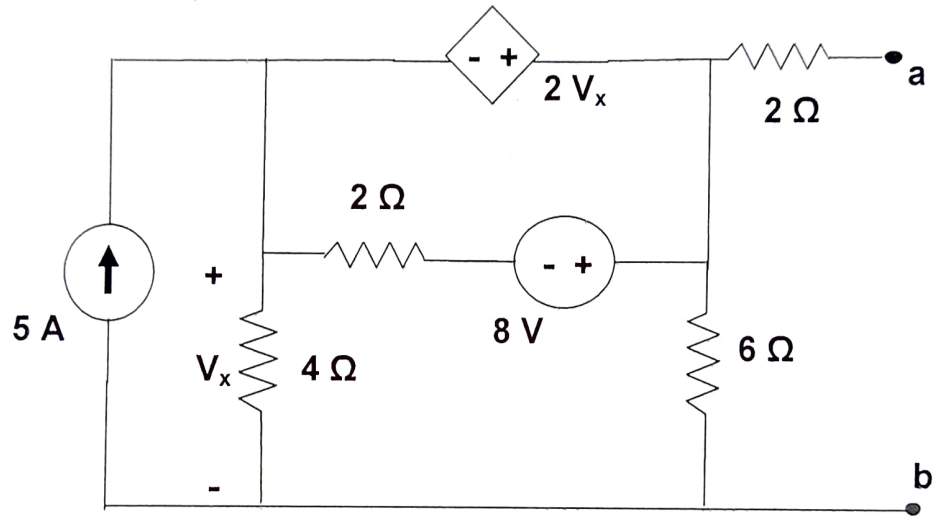
NUST School of Electrical Engineering and Computer Science
(Department of Electrical Engineering)
EE 111

Name: Muhammad Umer Total Marks : 10

Regn Number / Section: 345834 12-C

Home Assignment No 3 : Norton Equivalent Circuit (CLO 3)

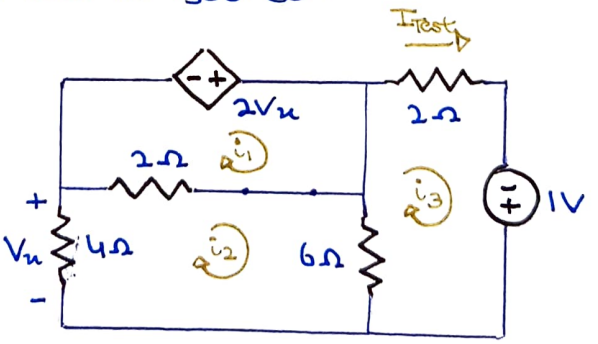
Determine Norton equivalent across terminals a & b for the given circuit.
(Please upload it as one pdf file only with name HA No 3. Show all steps. For more space use only A4 size paper.)



- We find R_{TH} first by connecting a test source and eliminating independent source.

$$\therefore R_{TH} = \frac{V_{Test}}{I_{Test}}$$

$$\therefore V_x = -4i_2$$



- Mesh 1: $-2V_x + 2(i_1 - i_2) = 0$

$$-2(-4i_2) + 2i_1 - 2i_2 = 0$$

$$2i_1 + 6i_2 = 0 \quad (1)$$

- Mesh 2:

$$2(i_2 - i_1) + 6(i_2 - i_3) + 4i_2 = 0$$

$$-2i_1 + 12i_2 - 6i_3 = 0 \quad (2)$$

- Mesh 3: $2i_3 - 1 + 6(i_3 - i_2) = 0$

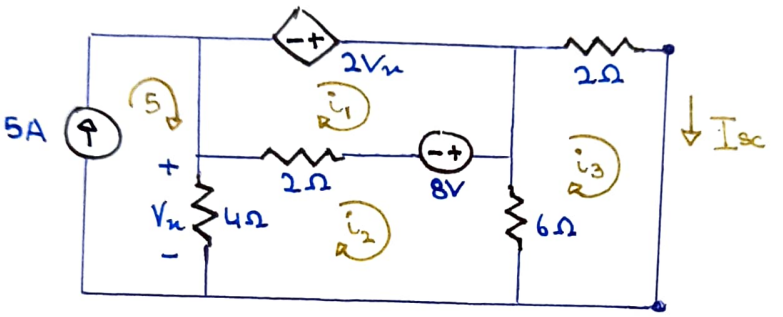
$$-6i_2 + 8i_3 = 1 \quad (3)$$

Solving (1), (2) and (3)

$$i_3 = I_{Test} = \frac{1}{6}\,A$$

$$\therefore R_{Th} = \frac{1}{I_{Test}} = \frac{1}{1/6} = 6\,\Omega$$

- We find I_N or I_{sc} by connecting a wire between a & b.



$$\therefore I_{sc} = i_3$$

$$V_x = 4(5 - i_2)$$

- Mesh 1: $-2V_x + 8 + 2(i_1 - i_2) = 0$

$$-2[4(5 - i_2)] + 8 + 2(i_1 - i_2) = 0 \Rightarrow -4(5 - i_2) + 4 + i_1 - i_2 = 0$$

$$i_1 + 3i_2 = 16 \quad (1)$$

- Mesh 2: $4(i_2 - 5) + 2(i_2 - i_1) - 8 + 6(i_2 - i_3) = 0$

$$2(i_2 - 5) + i_2 - i_1 - 4 + 3(i_2 - i_3) = 0$$

$$-i_1 + 6i_2 - 3i_3 = 14 \quad (2)$$

- Mesh 3: $2i_3 + 6(i_3 - i_2) = 0 \Rightarrow -6i_2 + 8i_3 = 0$

$$-3i_2 + 4i_3 = 0 \quad (3)$$

Solving (1), (2) and (3)

$$\therefore i_3 = I_{sc} = 3.33\,A$$

- Norton Equivalent Circuit: