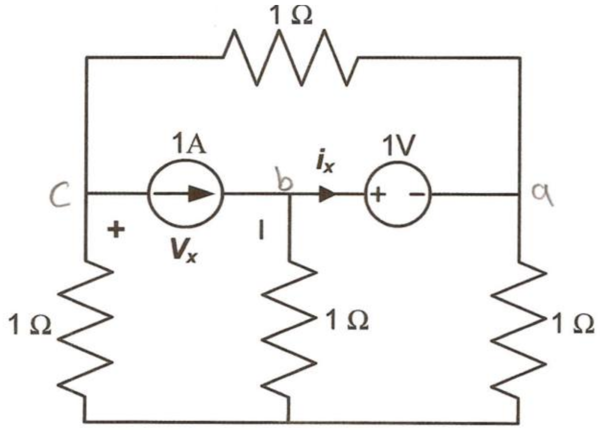
King Fahd University Of Petroleum & Minerals
Department of Electrical Engineering
2009-2010 First Semester (091)

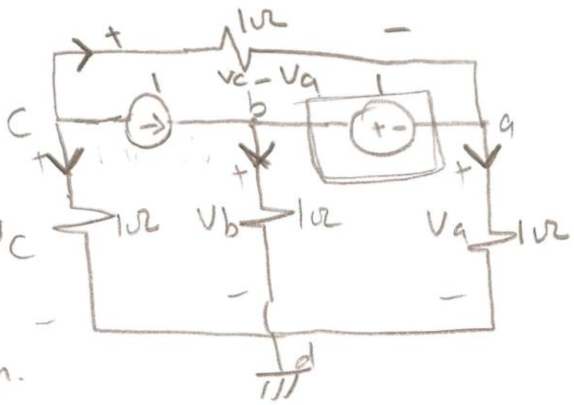
EE204 – HW # 2

Ser	Name	ID#	SEC#

1. Node-Voltage Method

1) Lable the four nodes
2) Take d as reference node.
3) Leble the remaining non-reference nodes by Voltages.
4) express the voltage across every resistor in terms of the node Voltages and Chose the polarity
5) choose the direction of the current in each resistor based on passive sign convention.
6) The Voltage source is taken as supernode.





$V_b - V_a = 1$ ---- (1)

KCL at node C :.

$V_c + V_c - V_a = -1$

$\therefore\ 2V_c - V_a = -1$ ---- (2)

KCL at the supernode :

$V_a + V_b - (V_c - V_a) = 1$

$\therefore\ 2V_a + V_b - V_c = 1$ ---- (3)

from (1) $V_b = 1 + V_a$

& subtitute in (3)

$2V_a + 1 + V_a - V_c = 1$

$3V_a - V_c = 0 \Rightarrow V_c = 3V_a$

substitute for V_c in (2)

$6V_a - V_a = -1$

$\therefore\ 5V_a = -1 \Rightarrow \boxed{V_a = \frac{-1}{5}}$

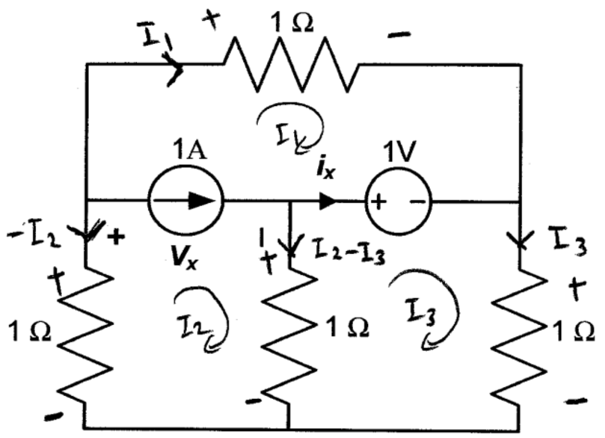
$\boxed{V_c = -\frac{3}{5}\ V}$; $\boxed{V_b = \frac{4}{5} V}$

$v_x = V_c - V_b = -\frac{3}{5} - \frac{4}{5} = -\frac{7}{5} V$

$i_x = 1 - V_b = 1 - \frac{4}{5} = \frac{1}{5}\ A$

2. Mesh-Current Method:

1) Define the mesh currents
2) Choose a direction for the current in each resistor
3) write the total current through each resistor.
4) lable the voltage across each resistor according to the passive sign convention



$I_2 - I_1 = 1$ ---- ①

KVL for mesh current 3 (M3)

$I_3 - (I_2 - I_3) = -1$

$2I_3 - I_2 = -1$ ---- ②

KVL for $(M_1 + M_2)$:-

$(I_2 - I_3) - (-I_2) + I_1 = 1$

$2I_2 - I_3 + I_1 = 1$ ---- ③

from ① $I_1 = I_2 - 1$

subtitute in ③

$2I_2 - I_3 + I_2 - 1 = 1$

$3I_2 - I_3 = 2$ ---- *

from ②

$I_2 = 2I_3 + 1$

subtitute in *

$3(2I_3 + 1) - I_3 = 2$

$6I_3 + 3 - I_3 = 2$

$5I_3 = -1 \Rightarrow$ $\boxed{I_3 = -\frac{1}{5} A}$

$I_2 = -\frac{2}{5} + 1 \Rightarrow$ $\boxed{I_2 = \frac{3}{5} A}$

$I_1 = I_2 - 1 \Rightarrow$ $\boxed{I_1 = -\frac{2}{5} A}$

$\therefore i_x = I_3 - I_1$

$= -\frac{1}{5} + \frac{2}{5} = \frac{1}{5}$ A

$V_x + (I_2 - I_3) - (-I_2) = 0$

$V_x + 2I_2 - I_3 = 0 \Rightarrow V_x = I_3 - 2I_2$

$\therefore V_x = -\frac{1}{5} - \frac{6}{5} = -\frac{7}{5}$

The power absorbed by the 1Ω resistor in the top is...

$P = I_1^2 R = (-\frac{2}{5})^2 (1) = \frac{4}{25}$ Watt (from method 2)

or from method 1.

$P = \frac{(V_c - V_a)^2}{R} = \frac{(-\frac{3}{5} + \frac{1}{5})^2}{1} = (-\frac{2}{5})^2 = \frac{4}{25}$ Watt.