Question 3) (10 Marks)

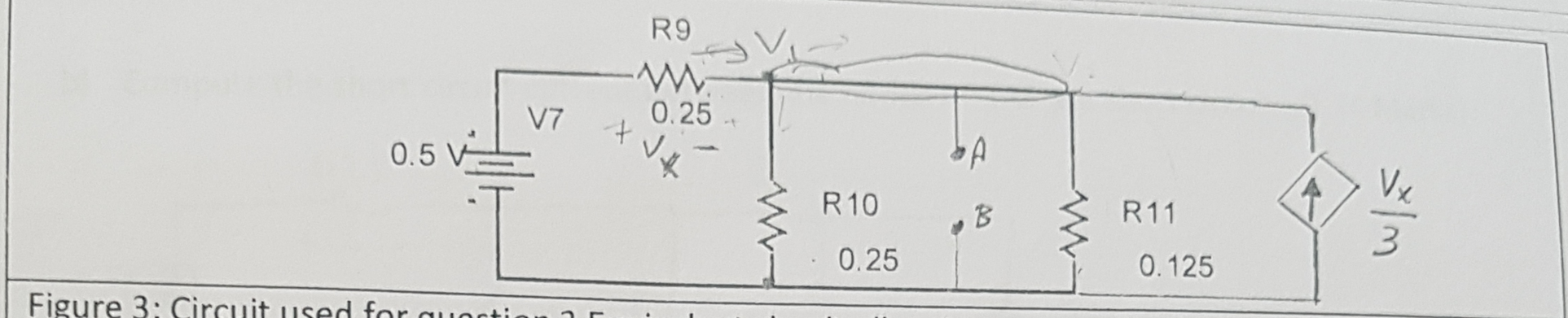


Figure 3: Circuit used for question 3 Equivalent circuit all resistances are in ohms

$V_x = 0.5 - V_1$

Use the circuit in figure 3 for this question.

a) Compute the open circuit voltage between the nodes AB (AB are open circuited). (4 Marks)

Thevenin:

$$\frac{V_1 - 0.5}{0.25} + \frac{V_1}{0.25} + \frac{V_1}{0.125} - \frac{\overbrace{0.5 + V_1}^{V_x}}{3} = 0$$

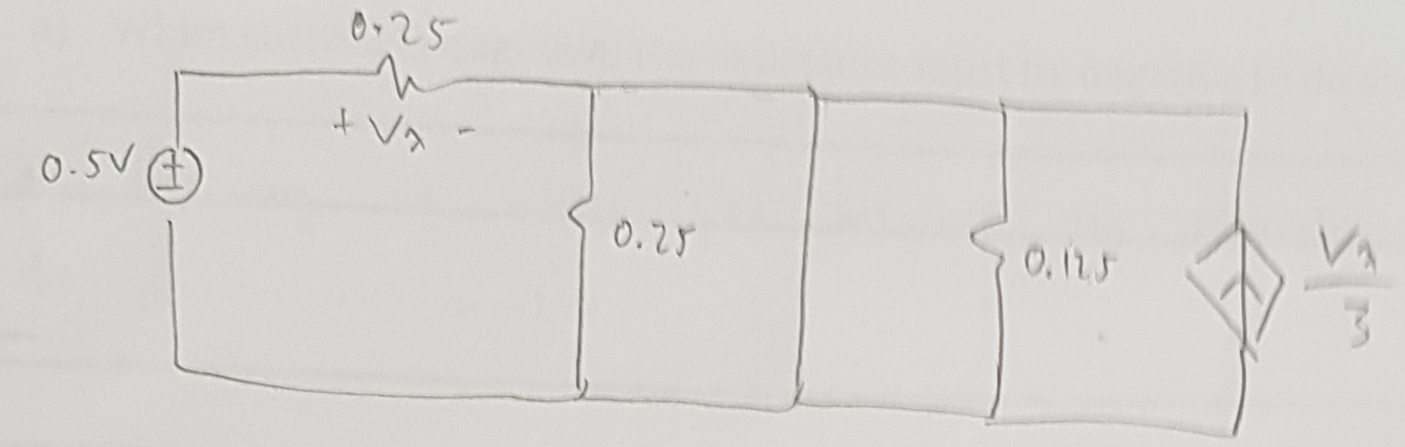
$$12V_1 - 6 + 12V_1 + 24V_1 - 0.5 + V_1 = 0$$

$$49V_1 = 6.5 \qquad V_1 = 0.133\ V \longrightarrow V_{th}$$

$V_{AB} = 0.133V$

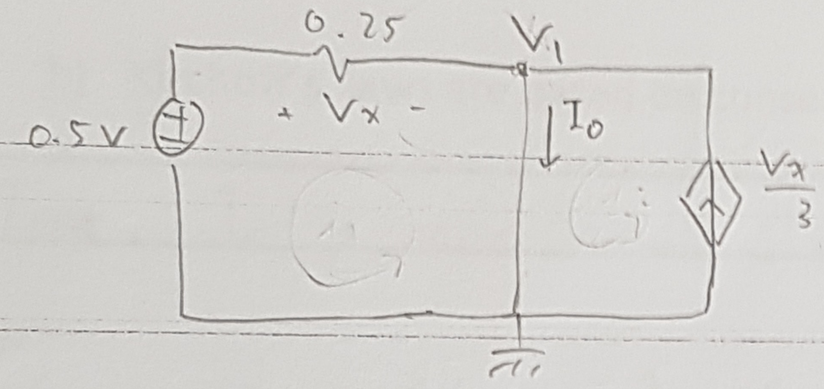
X 3 -

b) Compute the short circuit current between the nodes AB (AB are short circuited). (4 Marks)



short circuit makes the resistances have 0 current

$V_x = 0.5 - V_1$



$$\frac{V_1 - 0.5}{0.25} - \frac{V_x}{3} = 0 \qquad +I_o$$

$$\frac{V_1 - 0.5}{0.25} - \frac{0.5 - V_1}{3} = 0$$

$$12V_1 - 6 - 0.5 - V_1 = 0$$

$$11V_1 = 6.5 \qquad V_1 = 0.109\,V$$

$$V_x = 0.5 - 0.109 = 0.391\,V$$

$$I_o = \frac{0.391}{3} + \frac{0.5}{0.25}\,a$$

$$= 0.13 + 2 = 2.13A$$

$I_o = 2.13A$ ✗ 3

c) Compute the Thevenin equivalent resistance between the nodes AB: $R_{TH} = \frac{V_{OC}}{I_{SC}}$. (2 Marks)

$$R_{th} = \frac{0.133}{2.13} = 0.0624\,\Omega$$

✗ 1