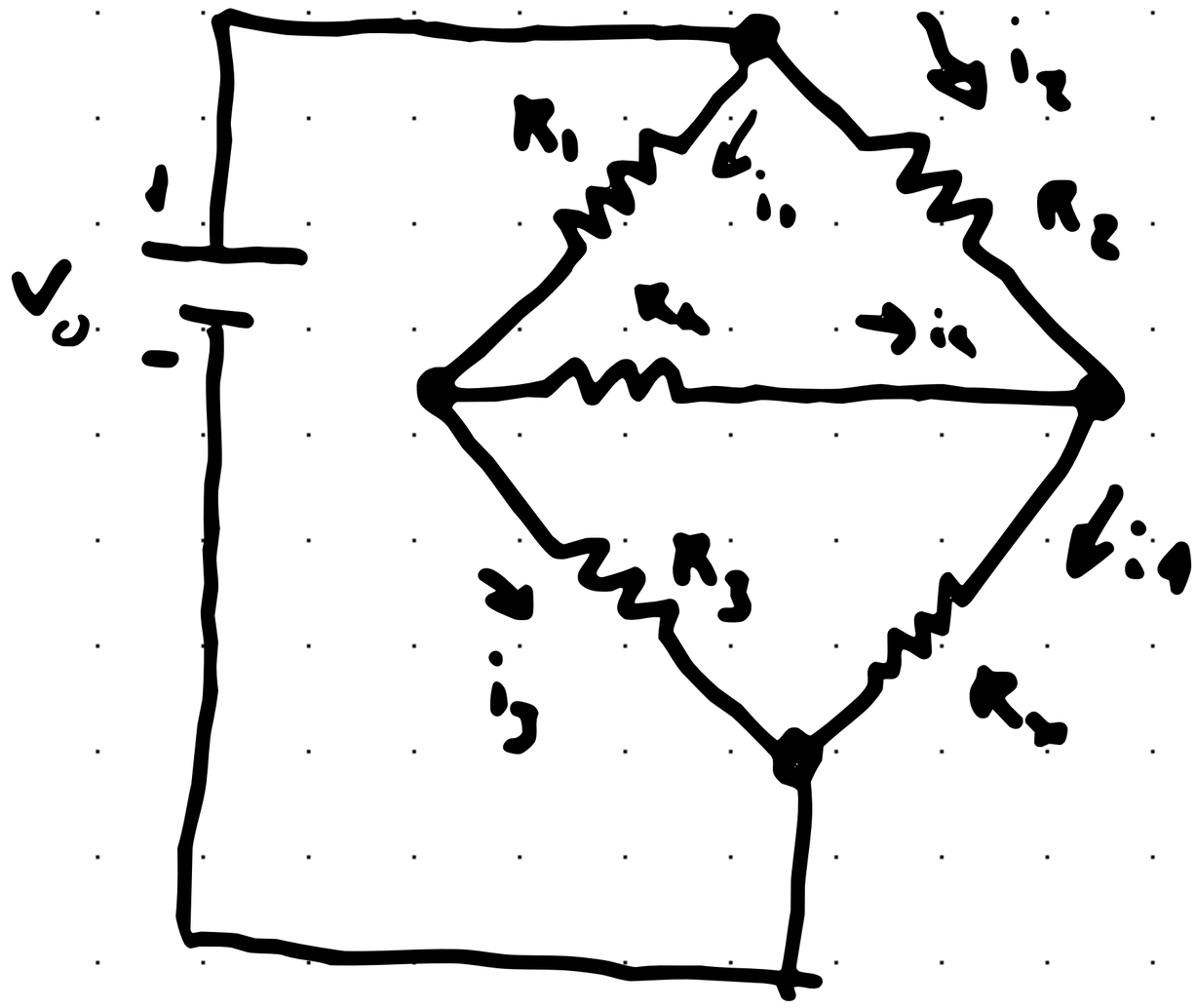
Tutorial 3 Solutions

ECED2000

a) If $R_1 = 1\Omega$,
$R_2 = 2\Omega$,
$R_x = 3\Omega$ what Value Should R_3 be adjusted So as to achieve a balanced Condition?



$$R_x R_1 = R_2 R_3$$

b) Using Wheatstone Bridge Equation

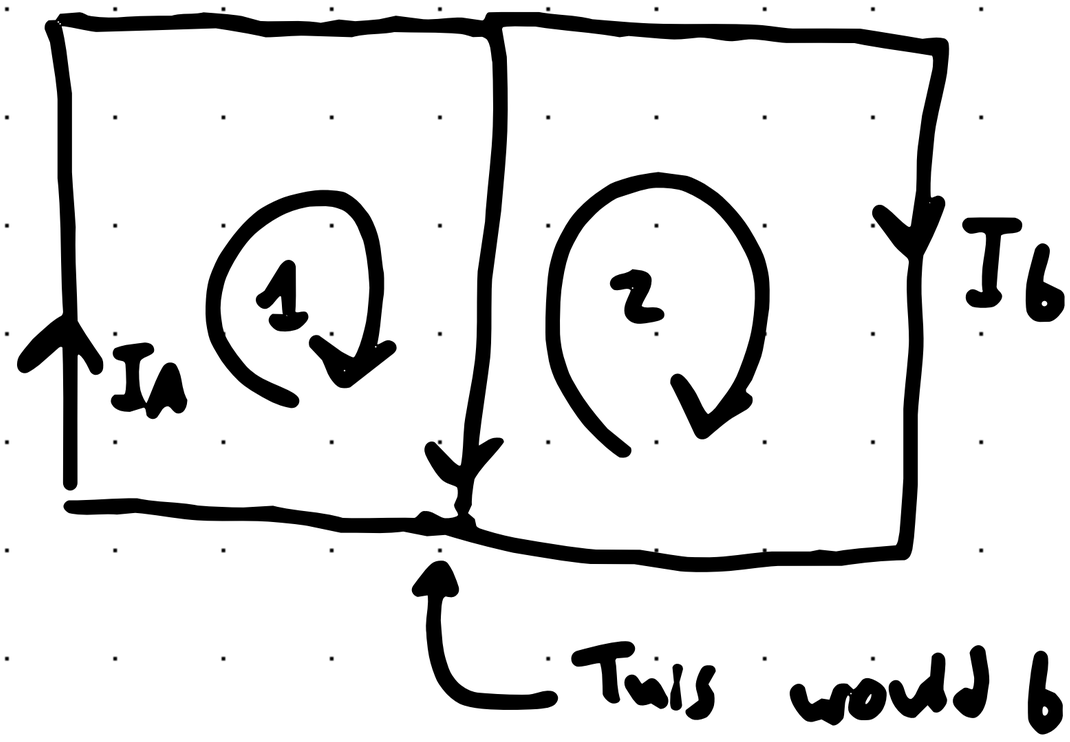
$$(3)(1) = (2) R_3$$

$$R_3 = \frac{3}{2} = 1.5\Omega$$

b) If $V_o = 6V$, $R_4 = 0.1\Omega$ and R_3 decreased to be 3.01Ω, what would be really on the Ammeter?

KVL and KCL will be here

Mesh Analysis

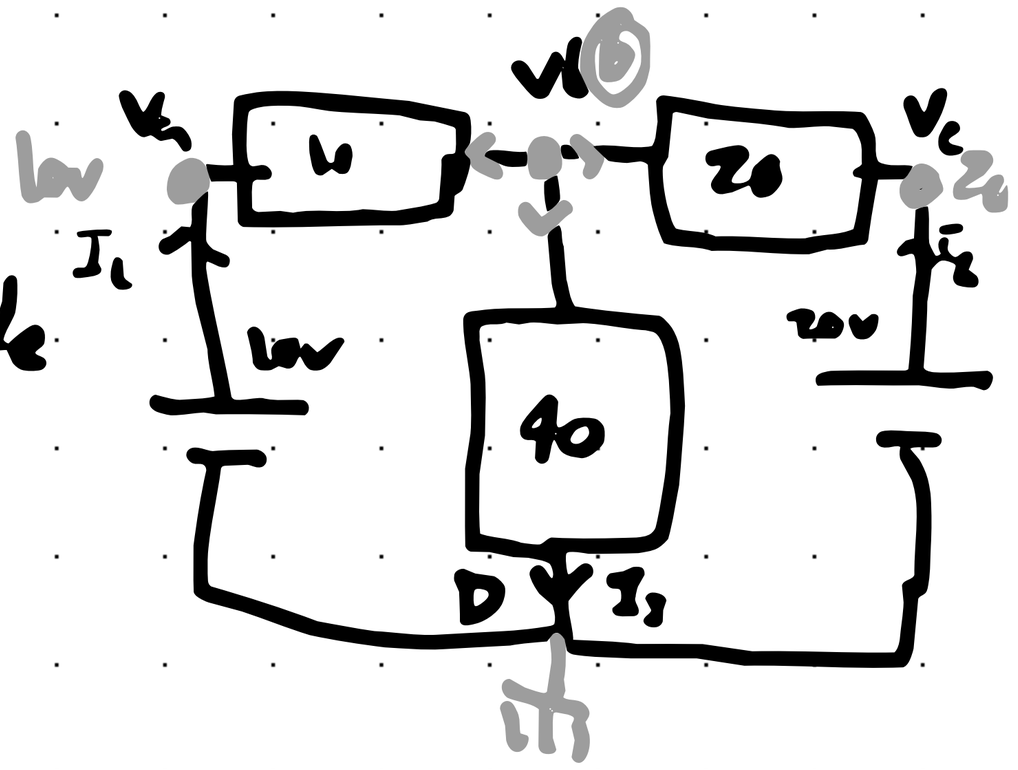


This would be $I_a - I_b$!

- Both loops have to be going the same way!
- Fundamentally very similar to KCL and KVL.

Problem 2

Calculate I_1, I_2, I_3 and calculate the total power dissipated.



Node Analysis

$$\sum_{\text{Node B}} I = 0 \qquad \frac{V_b - 10}{10} + \frac{V_b - 20}{20} + \frac{V_b}{40} = 0$$

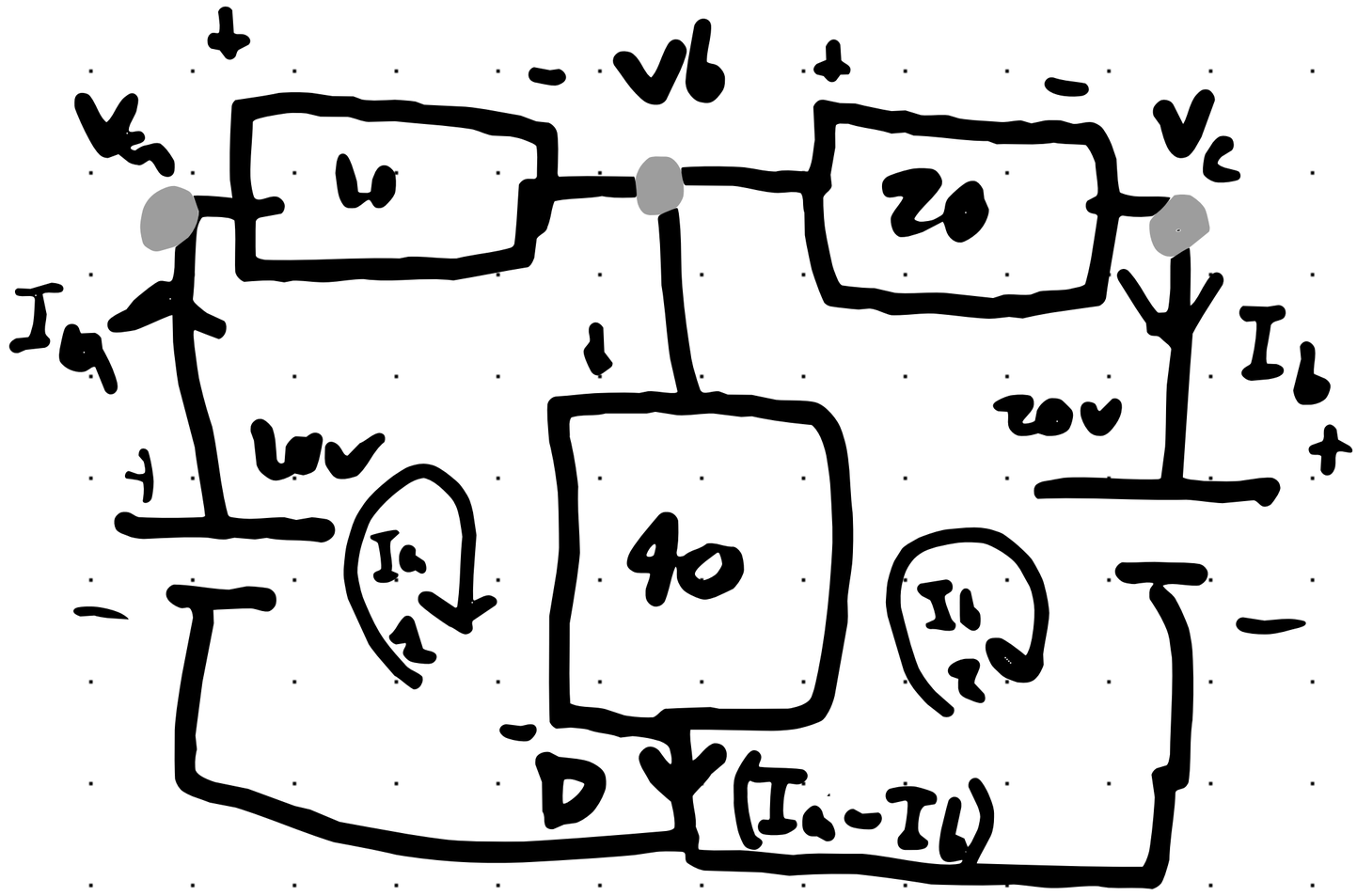
$$V_a = \frac{80}{7} V$$

$V = IR$

$$I_1 = \frac{10 - \frac{80}{7}}{10} = -0.14A \quad , \quad I_2 = \frac{20 - \frac{80}{7}}{20} = 0.43A$$

$$I_3 = \frac{V_b}{40} = \frac{\frac{80}{7}}{40} = \frac{2}{7}A$$

Now, do it with **Mesh Analysis**



$\sum V = 0$ mesh 1

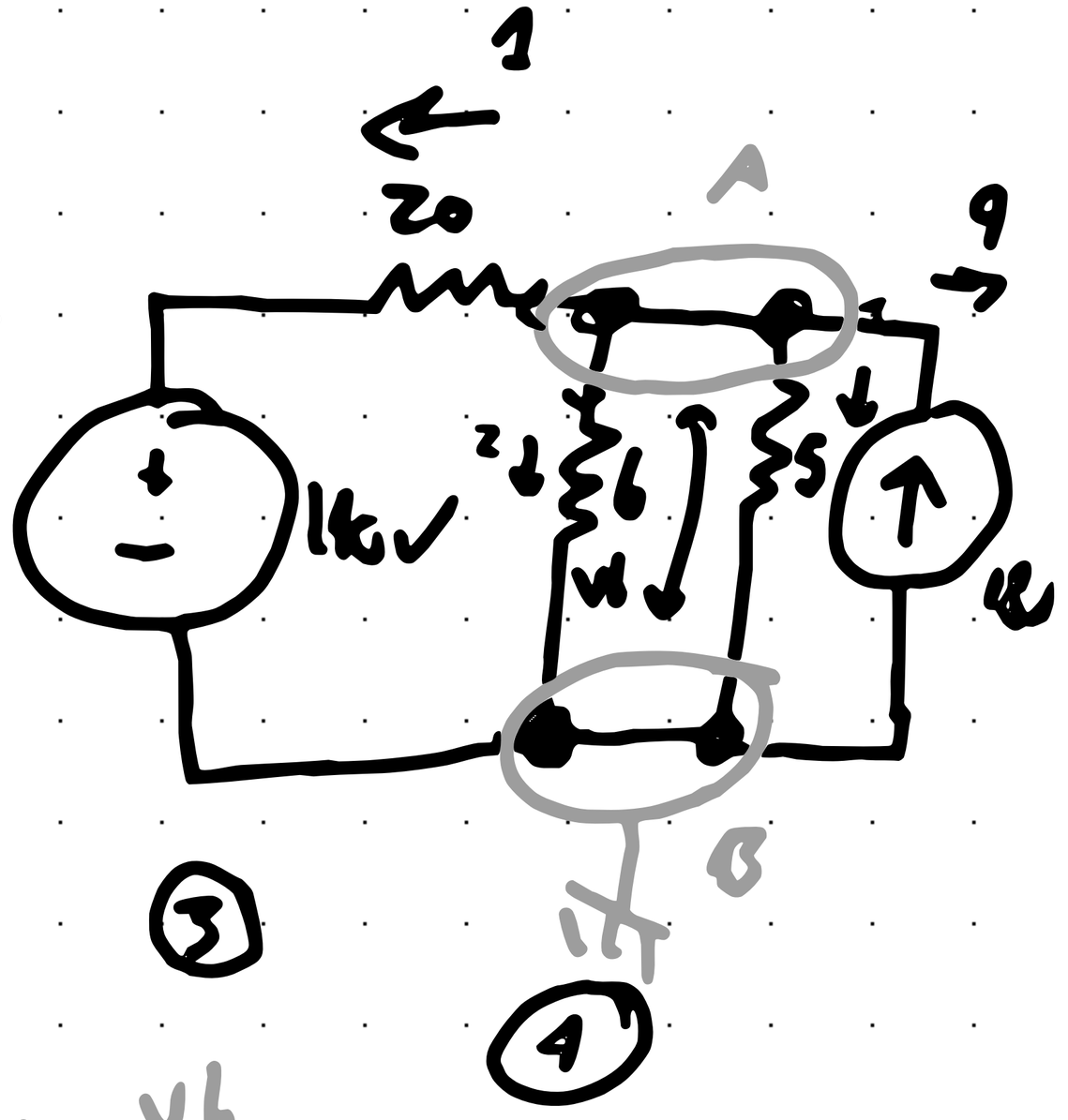
$$10 - 10I_a - 90(I_a - I_b) \quad (1)$$

$\sum V = 0$ mesh 2

$$90(I_a - I_1) - 20I_1 - 20 = 0 \quad (2)$$

Question 3

Use node analysis to calculate V_6 and the current in 20Ω



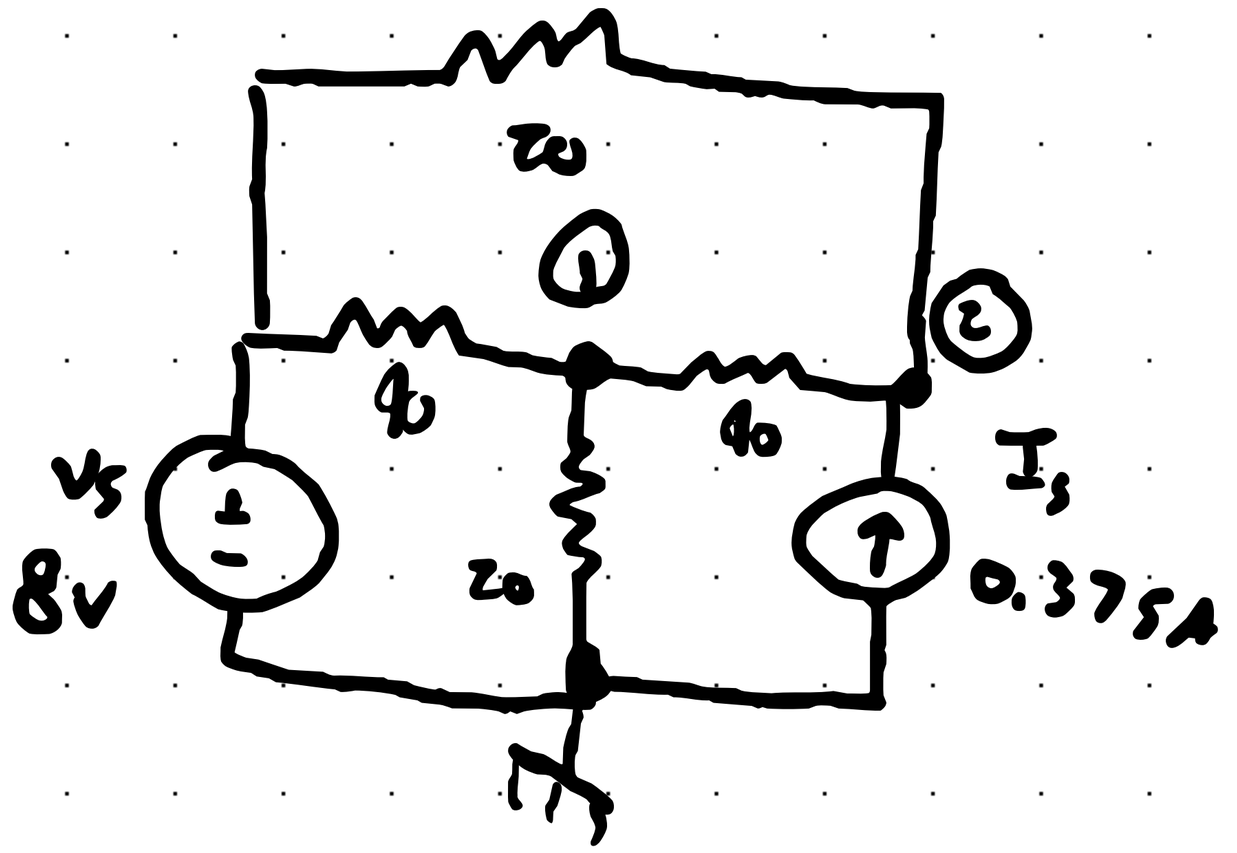
$$\sum I = 0 \quad \text{Node A}$$

$$\frac{V_6 - 1\text{kV}}{20} + \frac{V_6}{6} + \frac{V_6}{5} + (-18) = 0$$

$$V_6 = 60\text{V}$$

Question 4

Use the node voltage Method to Calculate the Current in R_1 and R_3



$$\sum I = 0 \quad \text{Node } ① \qquad \frac{V_1 - 8}{4} + \frac{V - 0}{20} + \frac{V_1 - V_2}{40}$$

$$\sum I = 0 \quad \text{Node } ② \qquad \frac{V_2 - V_1}{40} + \frac{V_1 - 8}{20} + (-0.375) = 0$$

$V_1 = 5V$ $\qquad$ $V_2 = 12V$

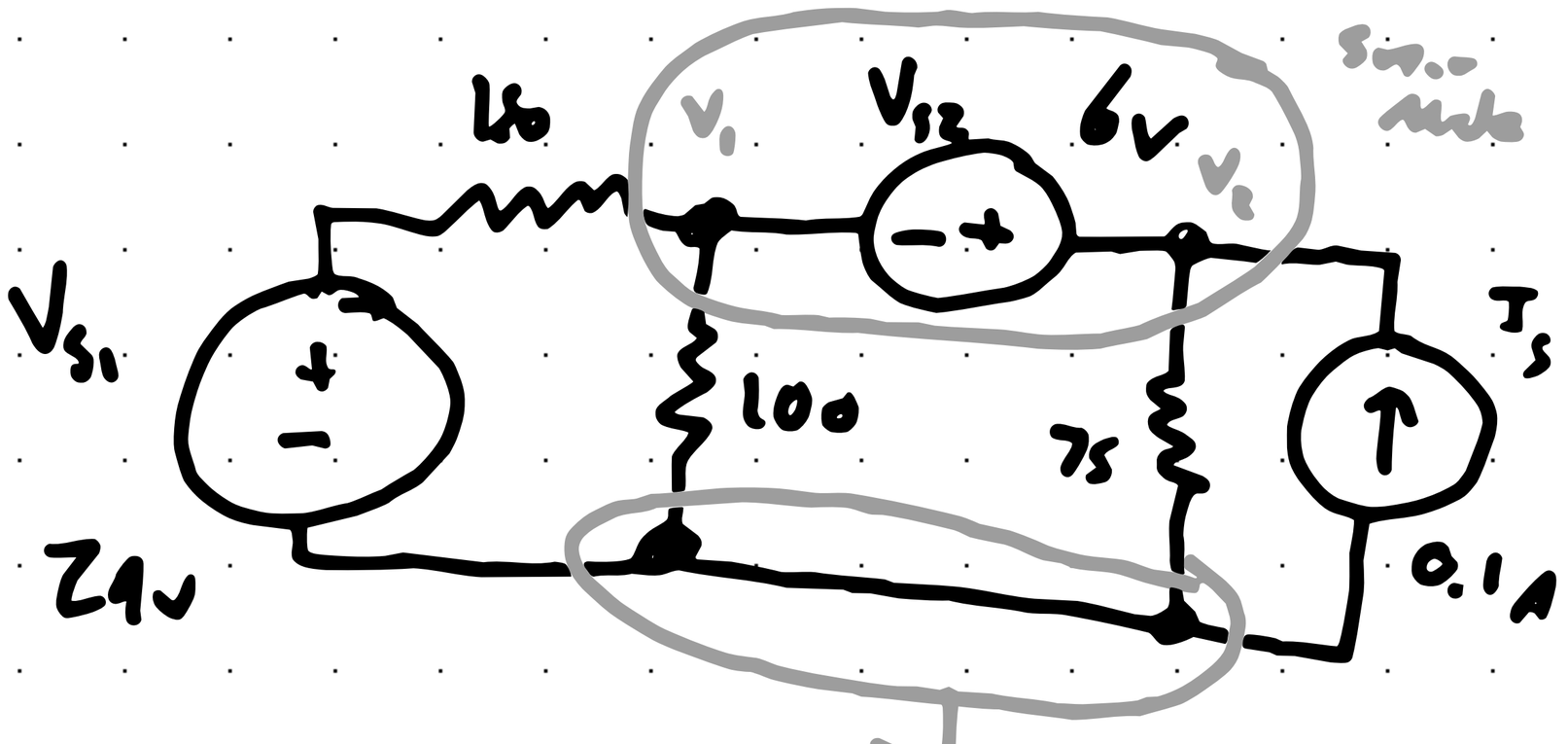
$$I_1 = \frac{8-5}{40} = \frac{3}{40}A$$

$$I_2 = \frac{V_2 - V_1}{40} = \frac{12-5}{40} =$$

0.175A

Q_5

Calculate the current in R_1 and R_2 using nodal Analysis



$\sum I = 0 \quad \frac{V_1 - 24}{150} + \frac{V_1}{100} + \frac{V_2}{75} + (0.1) = 0$ ①

$V_2 - V_1 = 6V, \quad V_2 = 6 + V_1$ ②

Sub eqn 2 into eqn 1

$$\frac{V_1 - 24}{150} + \frac{V_1}{100} + \frac{6 + V_1}{75} - 0.1 = 0$$

$V_1 = 6V$ $\quad V_2 = 6 + V_1 = 12V$

$$I_1 = \frac{24 - 6}{150} = \frac{18}{150} A$$

$$I_2 = \frac{V_2}{75} = \frac{12}{75} A$$