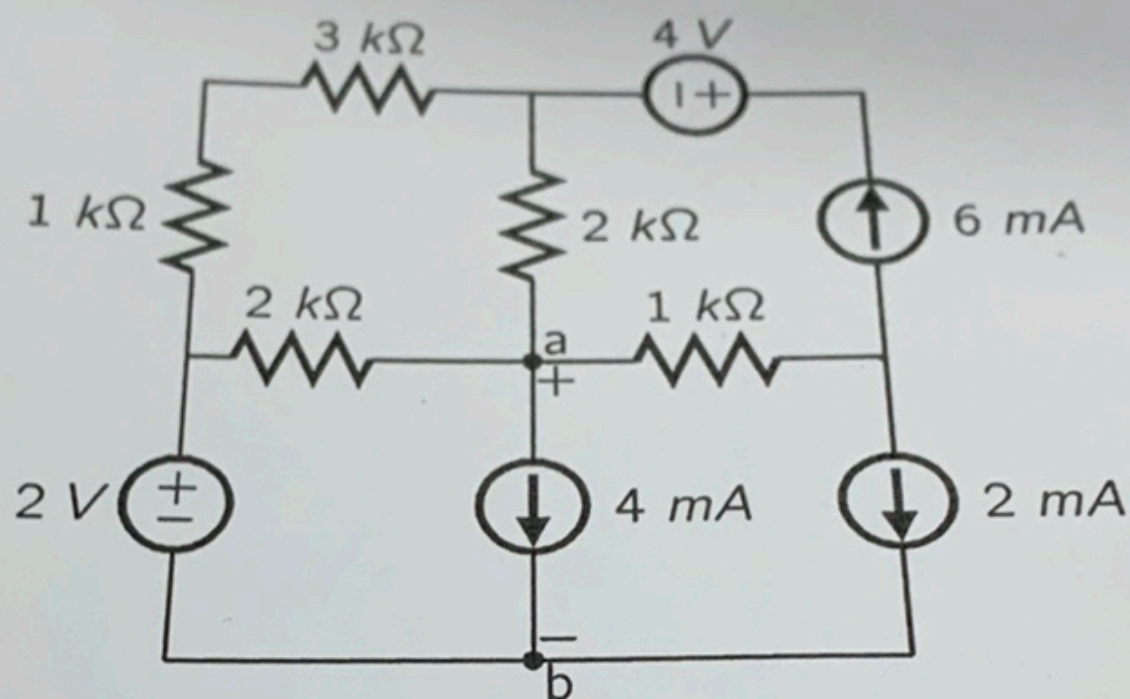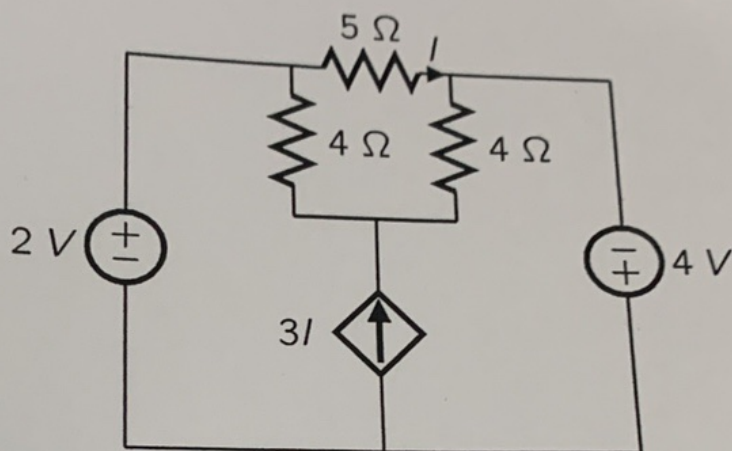1. (30 points) Thévenin Equivalent Circuit.
   Consider the following circuit.

a. [15 points] Find R_{TH} between the terminals $a - b$.

b. [10 points] Find V_{TH} between the terminals $a - b$. Remove the 4 mA source.

[5 points] Deduce the power delivered by the 4 mA current source.

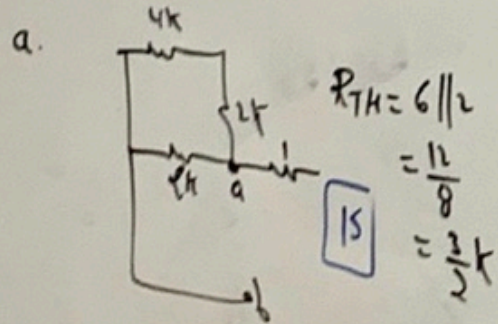3. (30 points) **Mesh Current Analysis.**
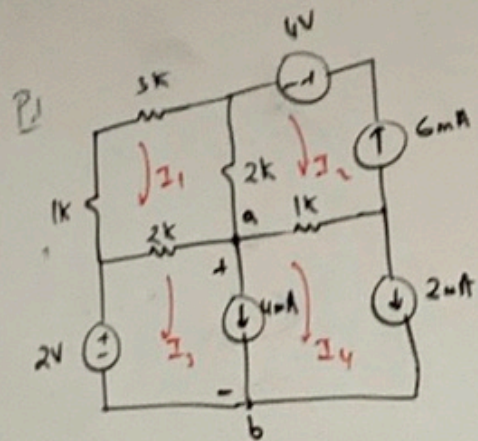Consider the following circuit

a. [15 points] Using the mesh current technique, find the current I.

b. [15 points] Using the mesh current technique, find R_{TH} between the terminals of the

4. **(20 points) Thévenin Equivalent.**

Using source transformation, find the Thévenin equivalent voltage V_{TH} between the terminals a and b in the following circuit.
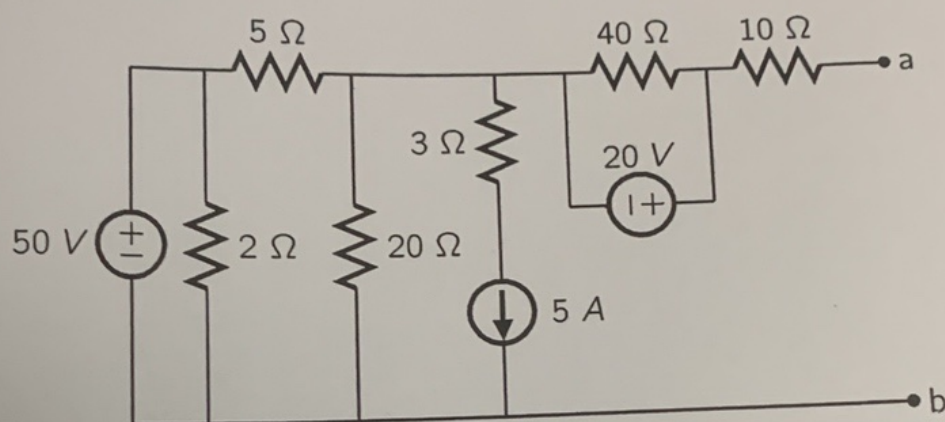
Exon 2 Correction
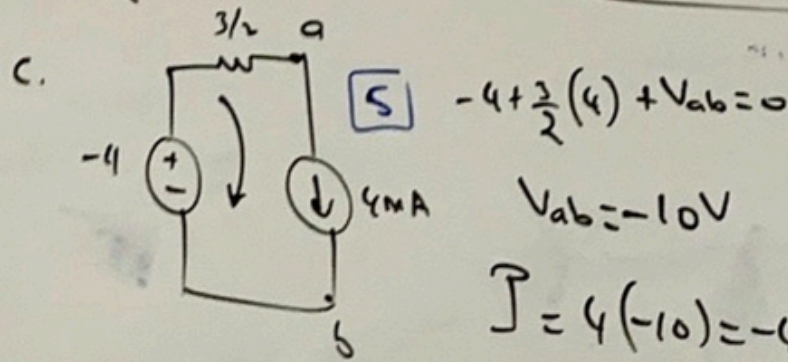

b.

$I_2 = -6mA$

$I_4 = 2mA$

$I_5 = 2mA$

$4 I_1 + 2(I_1 + 6) + 2(I_1 - 2) = 0$

$\boxed{10}$

$\Rightarrow I_1 = -1mA$

$2(2+1) + V_{oc} - 2 = 0 \Rightarrow \underline{V_{oc} = -4V = V_{TH}}$

c.

$\boxed{5}$ $-4 + \frac{3}{2}(4) + V_{ab} = 0$

$V_{ab} = -10V$

$P = 4(-10) = \underline{-40mW}$

a.

$R_{TH} = 6 \| 2$

$= \frac{12}{8}$
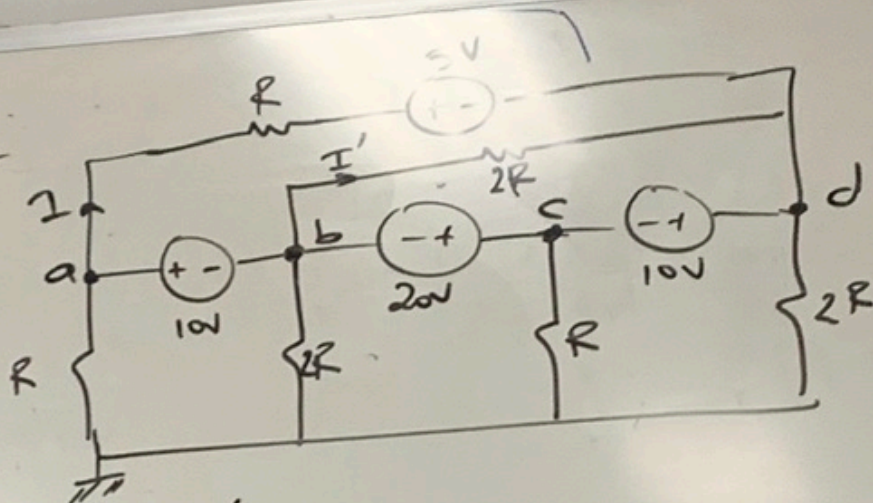
$\boxed{15}$

$= \frac{3}{2} k$

Correctio-

$L. \quad R=1$

$$P = \frac{V_a^2}{1} + \frac{V_b^2}{2} + \frac{V_c^2}{1} + \frac{V_d^2}{2} + \frac{(V_b - V_d)^2}{2}$$

$$+ \frac{(V_a - S - V_d)^2}{1}$$

$= 1350W$ (10)

2

P2

a) $\quad \frac{V_a}{R} + I + \frac{V_b}{2R} + I' + \frac{V_c}{R} + \frac{V_d}{2R} - I' - I = 0$

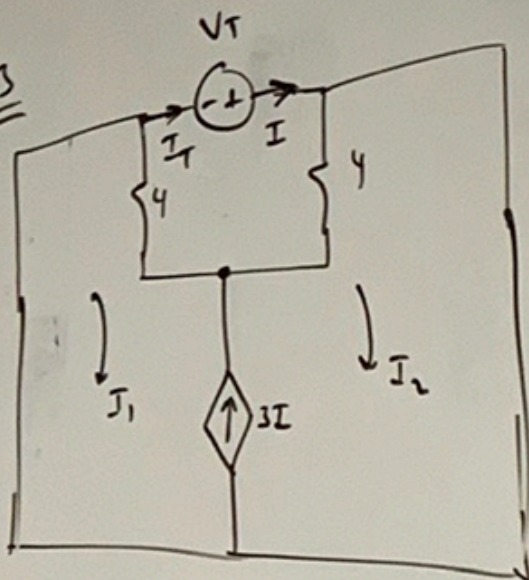(10) $\boxed{V_a + \frac{V_b}{2} + V_c + \frac{V_d}{2} = 0}$

$\begin{cases} V_a - V_b = 10 \Rightarrow V_b = V_a - 10 = -15V \\ V_c - V_b = 20 \Rightarrow V_c = V_a + 10 = 5V \\ V_d - V_c = 10 \Rightarrow V_d = V_a + 20 = 15V \end{cases}$

$V_a + \frac{V_a - 10}{2} + V_a + 10 + \frac{V_a + 20}{2} = 0 \Rightarrow \boxed{V_a = -5V}$

P.3

V_T

I_T I

4

4

J_1

$\uparrow 3I$

J_2

a.
$$\begin{cases} 5I + 4(I-I_2) + 4(I-I_1) = 0 \\ 4(I_1-I) - 2 - 4 + 4(J_2-I) = 0 \\ I_1 - I_1 = 3I \quad \boxed{15} \end{cases}$$

$\therefore I = \dfrac{6}{5} A$

b. $I = I_T$

$$\begin{cases} -V_T + 4(I-I_2) + 4(I-I_1) = 0 \\ 4(J_1-I) + 4(J_2-I) = 0 \\ I_2 - J_1 = 3I \end{cases}$$

$$\begin{cases} V_T = 8J_T - 4I_2 - 4J_1 = 0 \\ 4J_1 + 4J_2 = 8I_T \quad \boxed{15} \end{cases}$$

$\dfrac{V_T}{J_T} = 0 = R_{TH}$

3

P.4

Circuit 1: 50V source (with +/- polarity), 5Ω resistor on top, 20Ω resistor, 5A current source (↓), 20V source (-+), 10Ω resistor leading to terminal a, and terminal b.

Circuit 2: 10 current source (↑), 5Ω resistor, 20Ω resistor, 5 current source (↓), 20V source (-+), 10Ω resistor.

Circuit 3: 5 current source (↑), 4Ω resistor, 20V source (-+) with 10Ω resistor, 4Ω resistor, 20V source (-+) with 10Ω resistor, and =20V source (+/-).