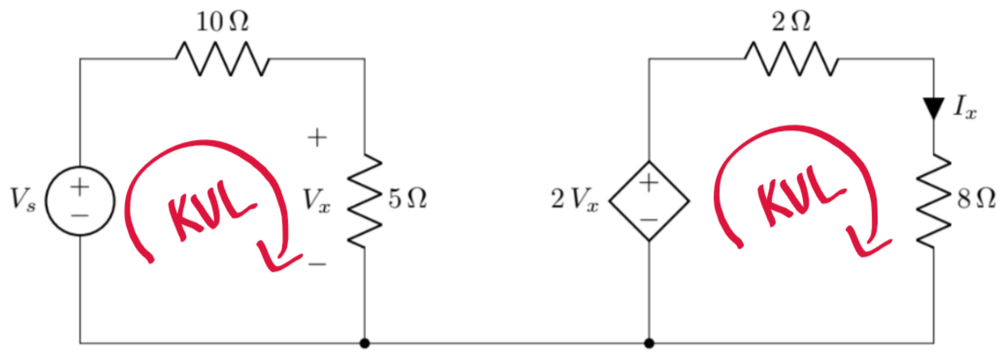
Set B

1)



a. $P = 8\ W$

Using $P = I^2R$,

$\Rightarrow 8 = I_x^2 \times 8$

$\therefore I_x = 1\ A$

b. KVL in right mesh,

$-2V_x + 2I_x + 8I_x = 0$

$\therefore V_x = 5V$

or use VDR,

$V_{8\Omega} = \frac{8}{2+8} \times 2V_x$

$\Rightarrow 8I_x = \frac{8}{10} \times 2V_x$

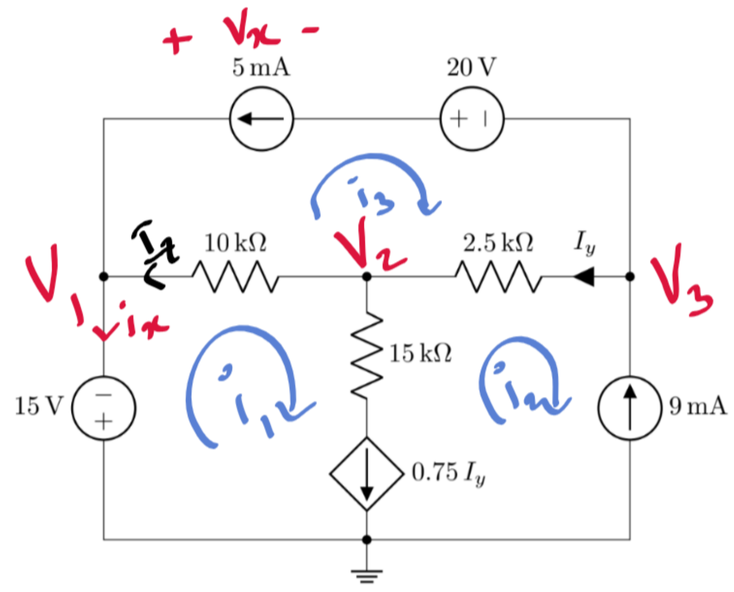
$\Rightarrow V_x = 5V$

c. Apply VDR in left mesh,

$\Rightarrow V_x = \frac{5}{5+10} \times V_s$

$\therefore V_s = 15\ V$

2)



b. see part (a).

a. **Method 1 : Nodal Analysis**

V_1 : $V_1 = -15$ — (i)

V_2 : $\frac{V_2 - V_1}{10} + 0.75I_y + \frac{V_2 - V_3}{2.5} = 0$

$\Rightarrow -2V_1 + 10V_2 - 8V_3 = 15I_y$ — (ii)

V_3 : $(-9) + \frac{V_3 - V_2}{2.5} + 5 = 0$

$\Rightarrow V_3 - V_2 = 10$ — (iii)

(ii) becomes $-V_1 + 2V_2 - V_3 = 0$

$I_y = \frac{V_3 - V_2}{2.5}$ — (iv)

solving,

$V_1 = -15V$, $V_2 = -5V$, $V_3 = 5V$

Method 2 : Mesh Analysis

(2): $i_2 = -9$ — (i) (There is no need to write an equation for mesh 1)

(3): $i_3 = -5$ — (ii)

and KCL equations -

(3 and 2) $I_y = i_3 - i_2$ — (iii)

(1 and 2) $0.75I_y = i_1 - i_2$ — (iv)

solve (iv) - becomes

$4i_1 - i_2 - 3i_3 = 0$

$\therefore i_1 = -6mA$

and $i_2 = -9\ mA$

$i_3 = -5\ mA$

i) $P_{5mA} = -5 \times V_x$

nodal: $= -5 \times (V_1 - V_3 - 20)$ $= 200\ mW$ (absorbed)

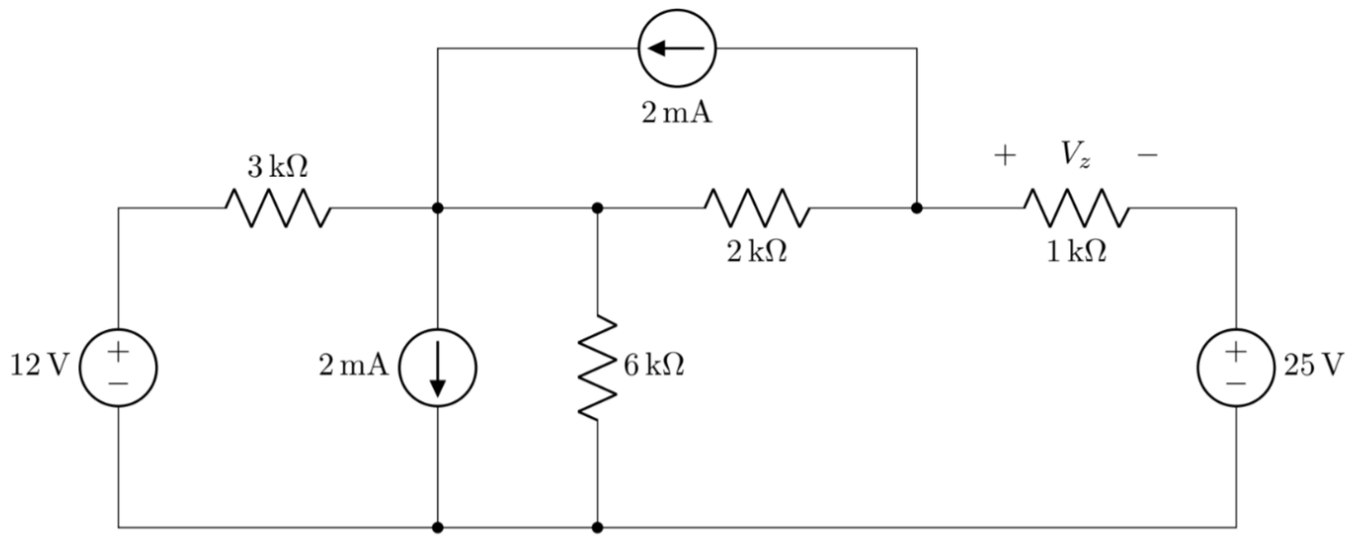
mesh: $= -5\left[-20 - 10(i_3 - i_1) - 2.5(i_3 - i_2)\right]$ $= 200\ mW$ (absorbed)

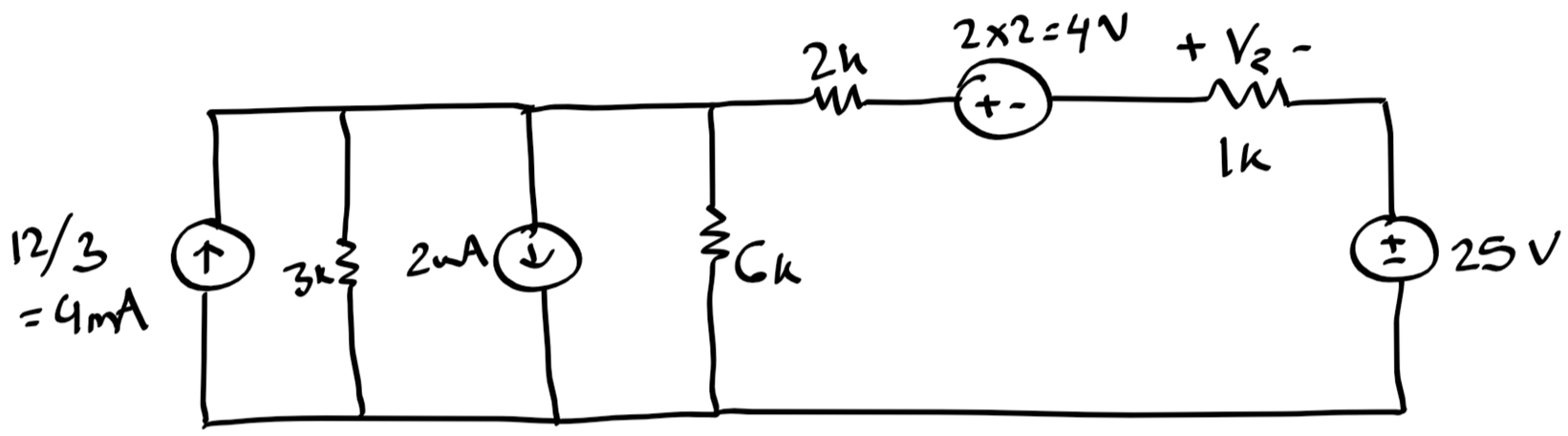
ii) $P_{15V} = -i_x \times 15$, $I_x = \frac{V_2 - V_1}{10}$

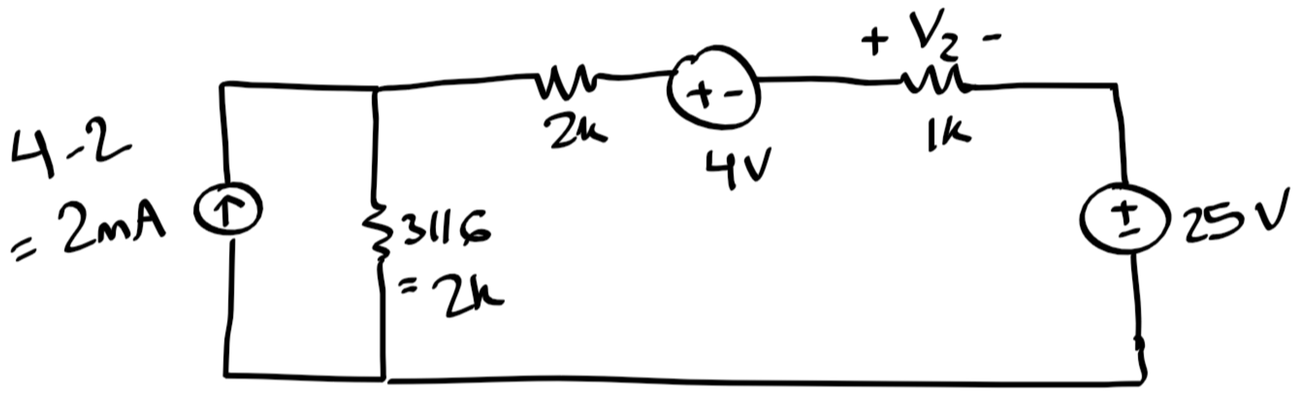
nodal: $= -(5 + I_x) \times 15$ $= -90\ mW$ (supplied)

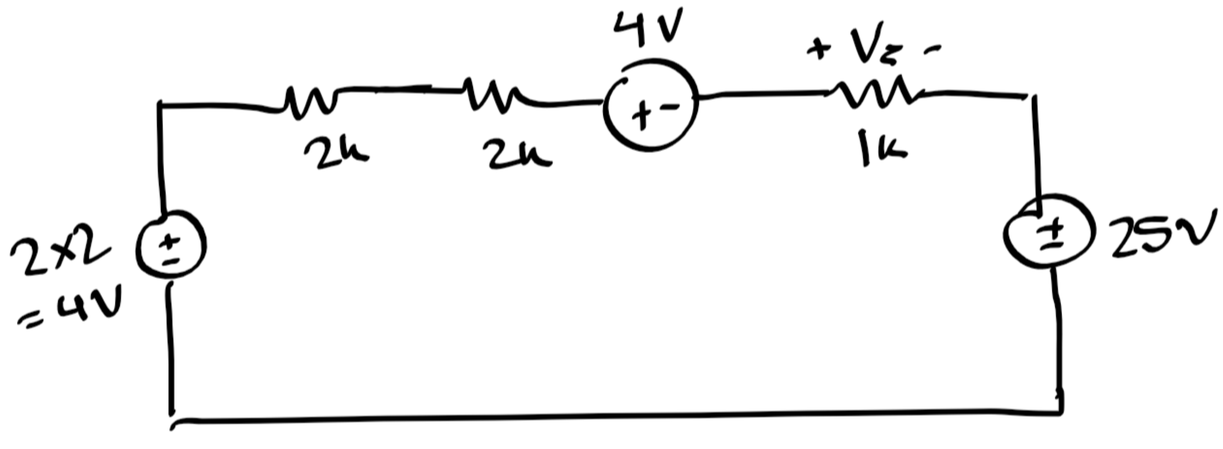
mesh: $= -(-i_1) \times 15$ $= -90\ mW$ (supplied)

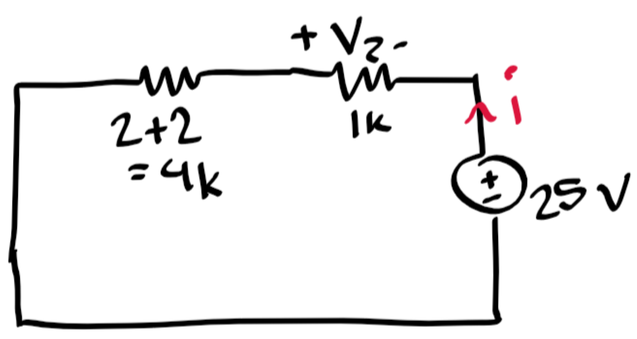
3)











KVL,

$-4i - 1i + 25 = 0$

$i = 5\,mA$

$\therefore V_z = -1i$

$= -5V$

or

VDR,

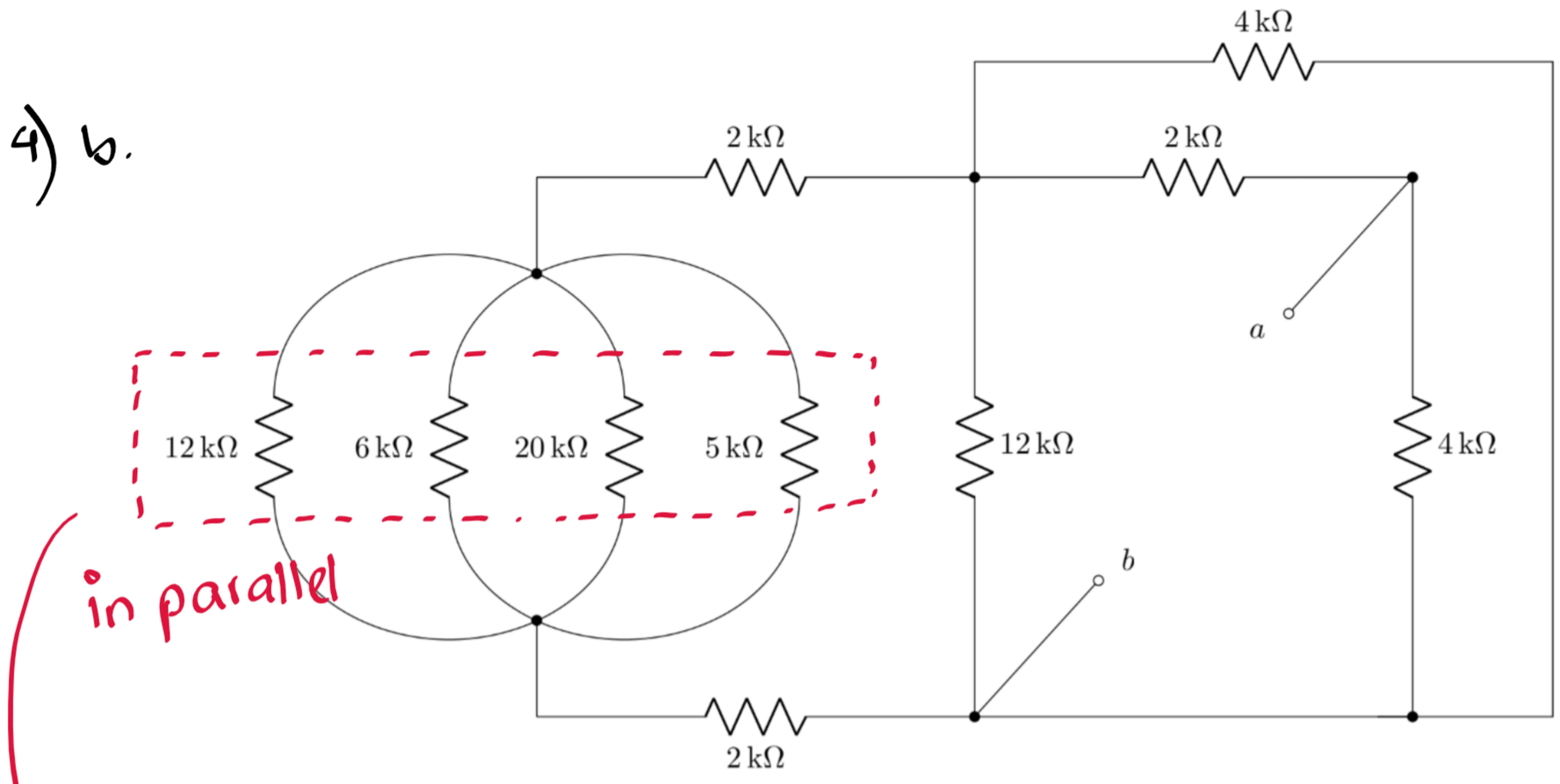
$V_z = -\frac{1}{1+4} \times 25$

$= -5V$

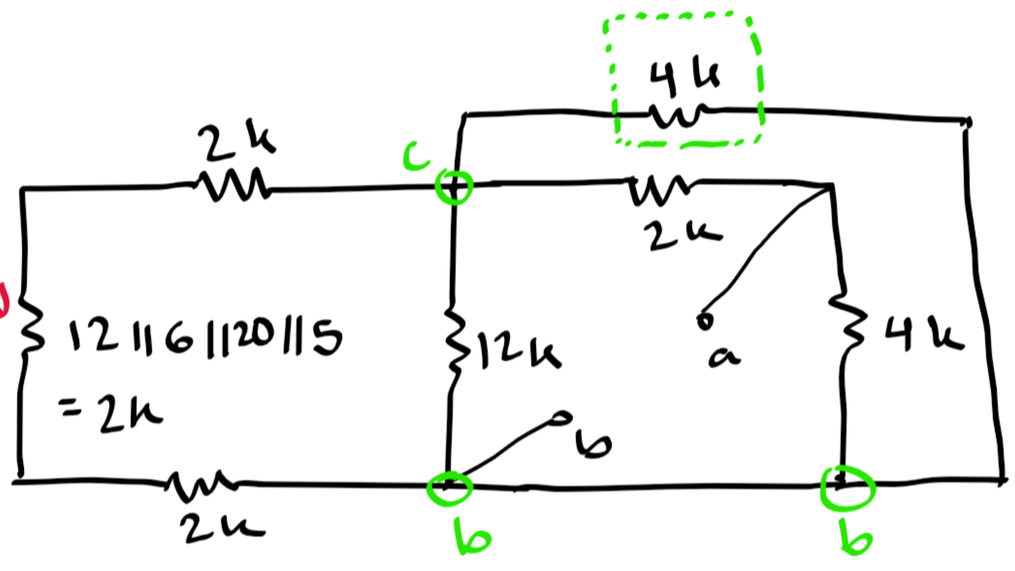
4) a. same as set A.

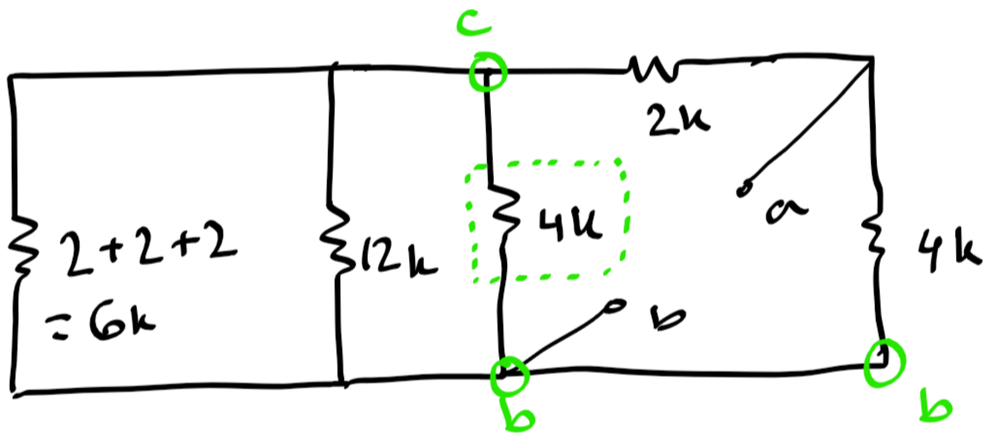
(nodes A and C have been interchanged)

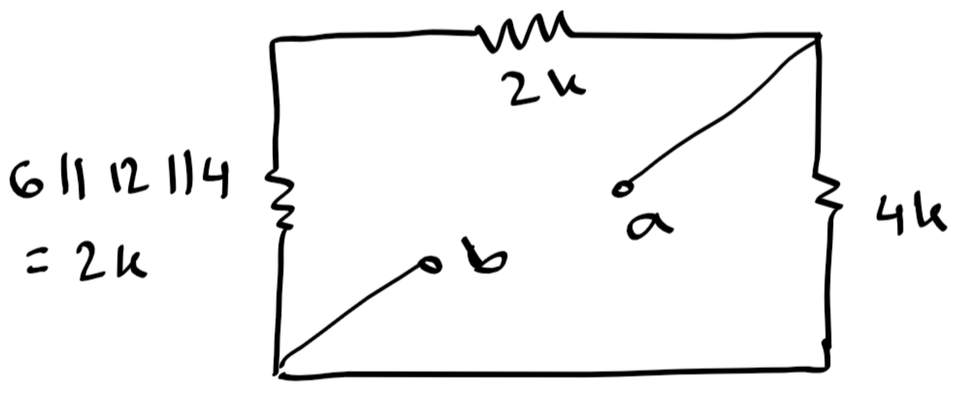
4) b.



in parallel







$\therefore R_{ab} = (2+2) \,||\, 4 = 2\,k\Omega$