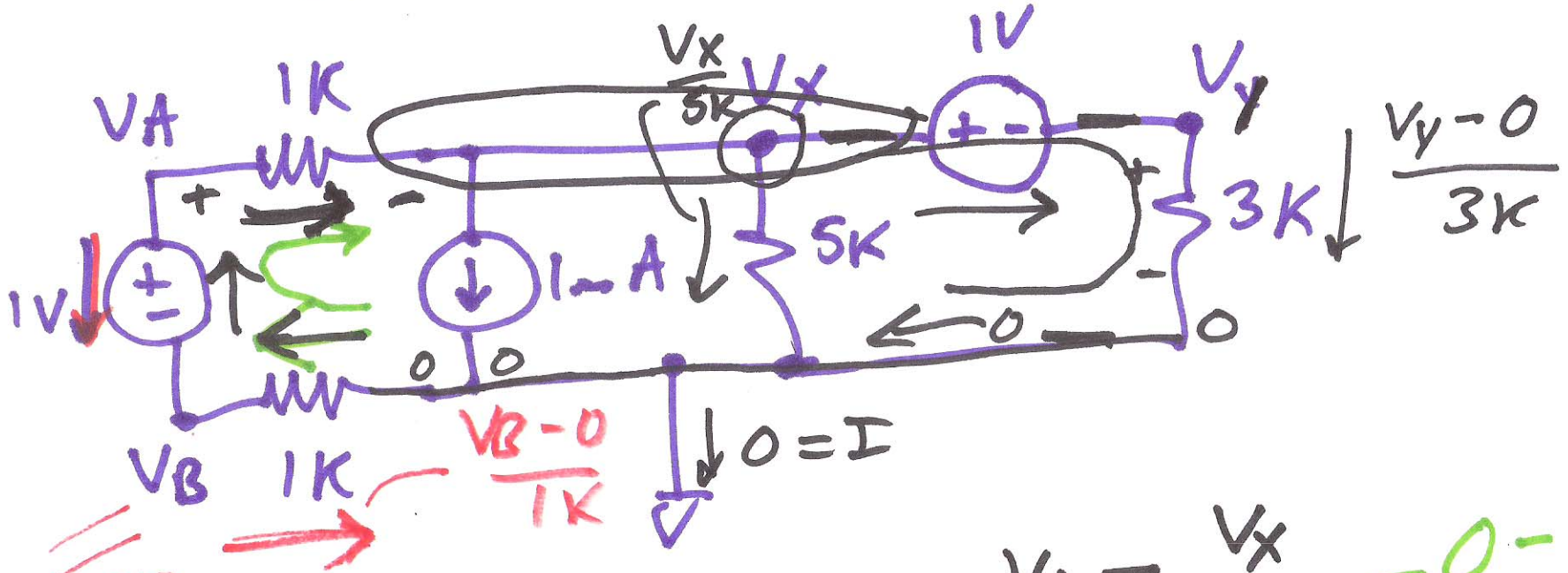
Lec 3 6/11/14

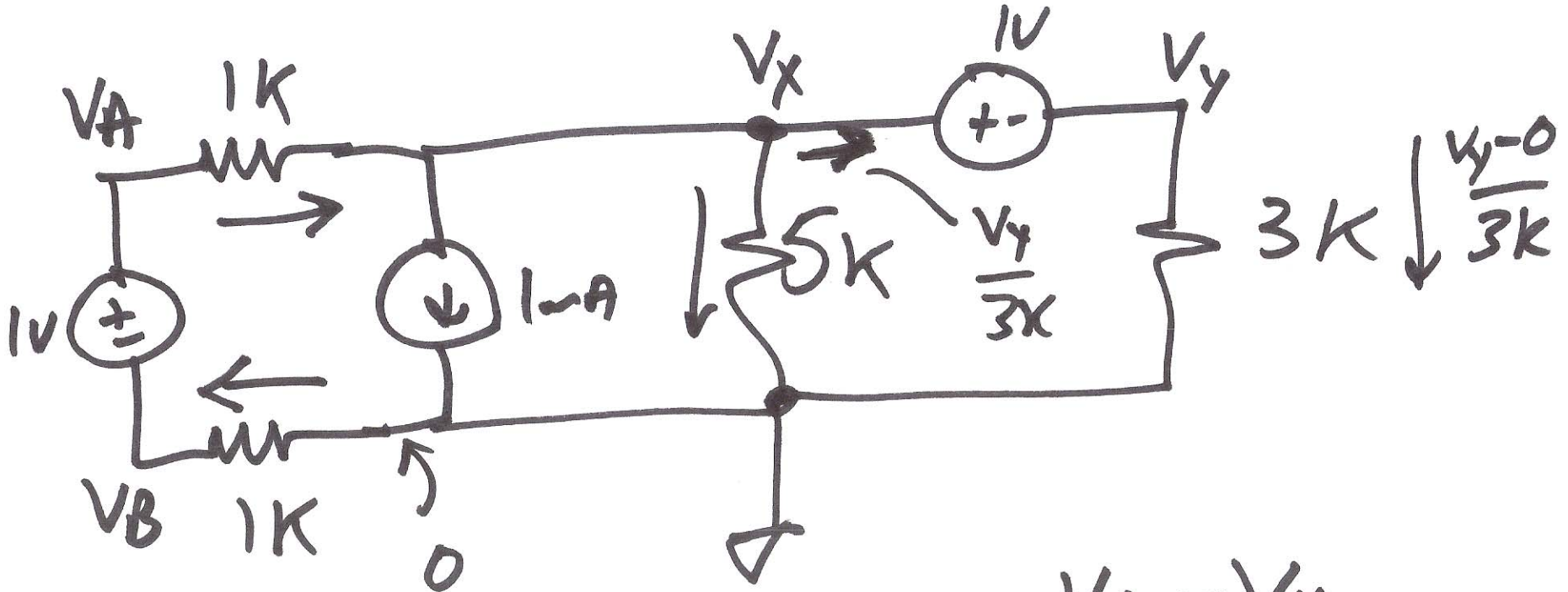
CIRCUITS I EE 220



$$V_A - 1 = V_B$$

$$\frac{V_y}{3K} + \frac{V_x}{5K} + 1mA = \frac{V_A - V_x}{1K} = \frac{0 - V_B}{1K}$$

Vx
Vy
VA VB



V_y
V_x
V_A
V_B

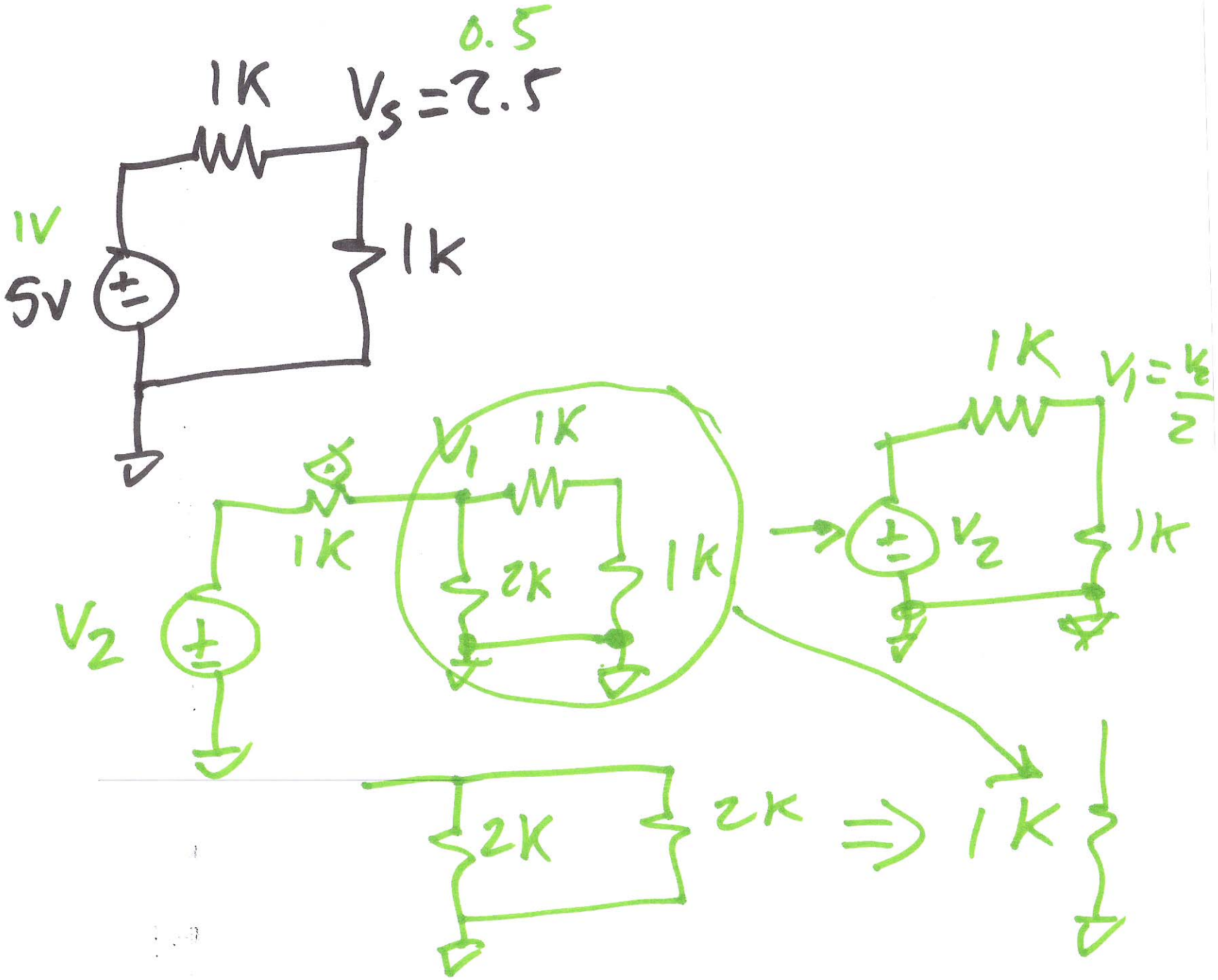
① $\frac{V_y}{3K} + \frac{V_x}{5K} + 1mA = \frac{V_A - V_x}{1K}$

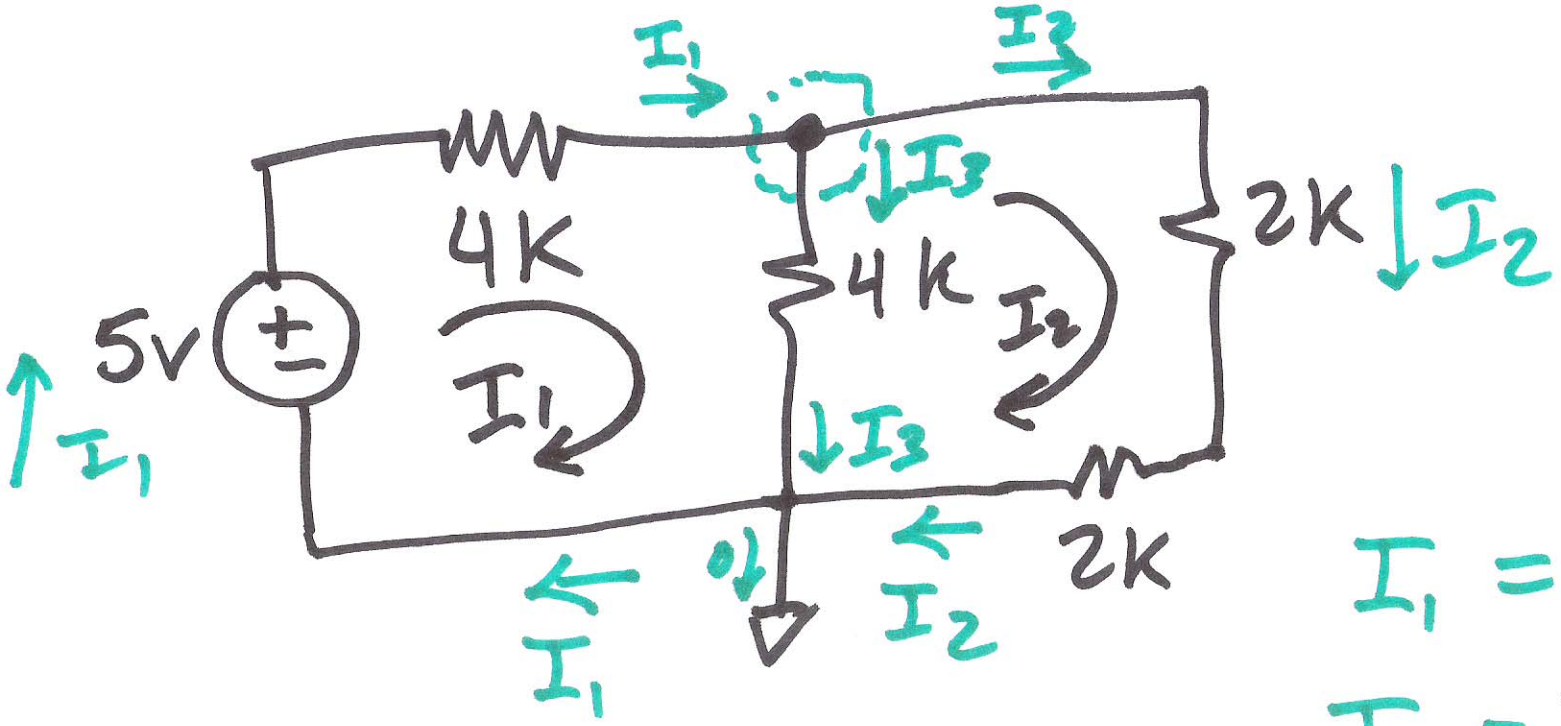
② $\frac{0 - V_B}{1K} = \frac{V_A - V_x}{1K}$,

$V_B = V_A - 1$ ③

$V_A - V_B = 1$

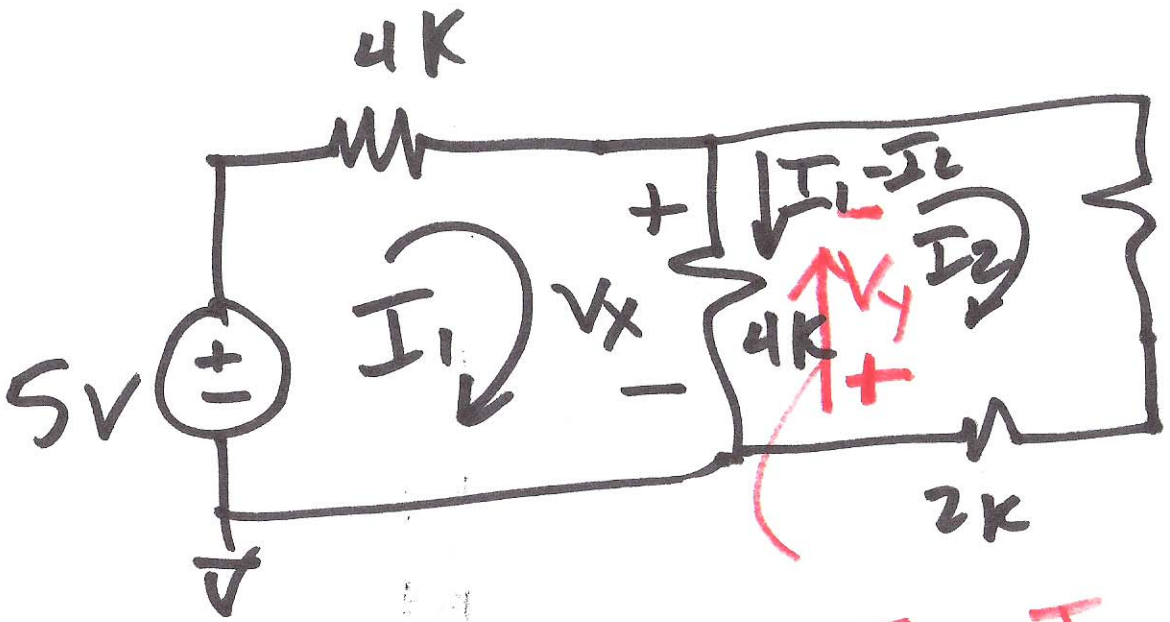
$V_x - V_y = 1$ ④


0.5
1K
$V_S = 2.5$
1V
5V
1k
1K
$V_1 = \frac{V_S}{2}$
V_1
1K
1K
2k
1k
V_2
V_2
1k
2K
2K
⇒ 1K



$$I_1 = I_2 + I_3$$

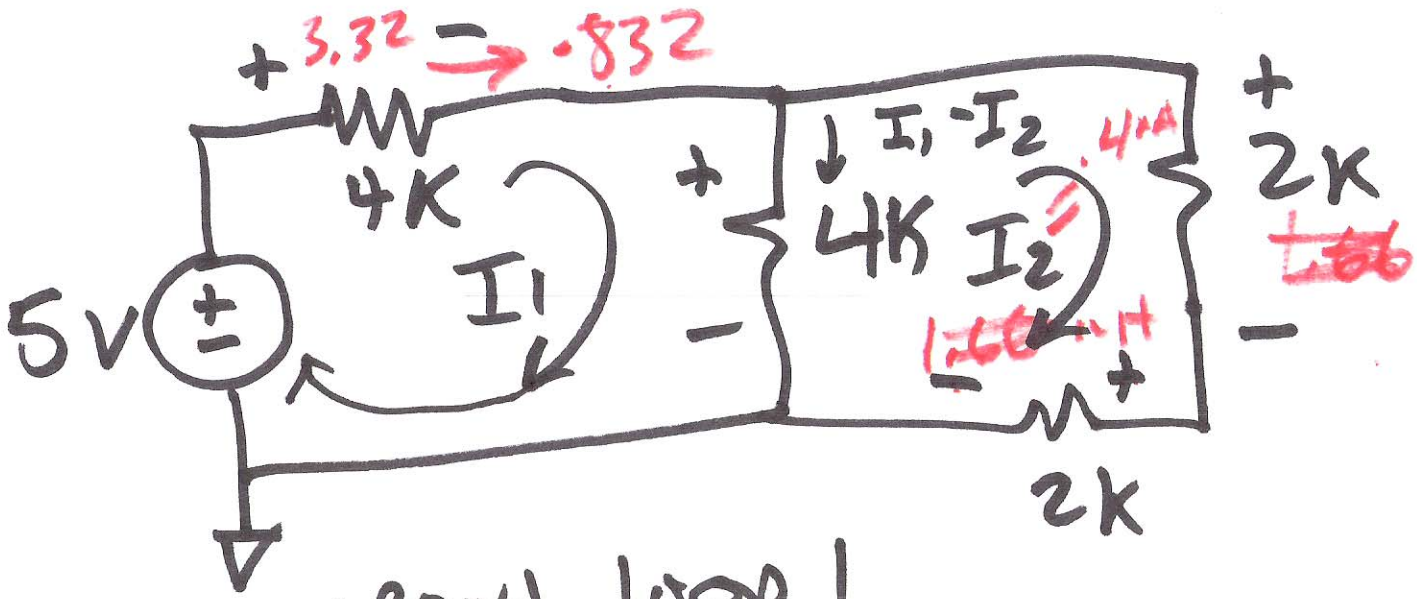
$$I_3 = I_1 - I_2$$



$$V_x = (I_1 - I_2)\,4K$$

$$V_x = -V_y$$

$$V_y = (I_2 - I_1)\,4K$$



4k · .416mA x2
= 1.66 x 2
= 3.32
2k · .416mA
= 1.66

KVL around loop 1

$$5 = 4k \cdot I_1 + 4k(I_1 - I_2)$$

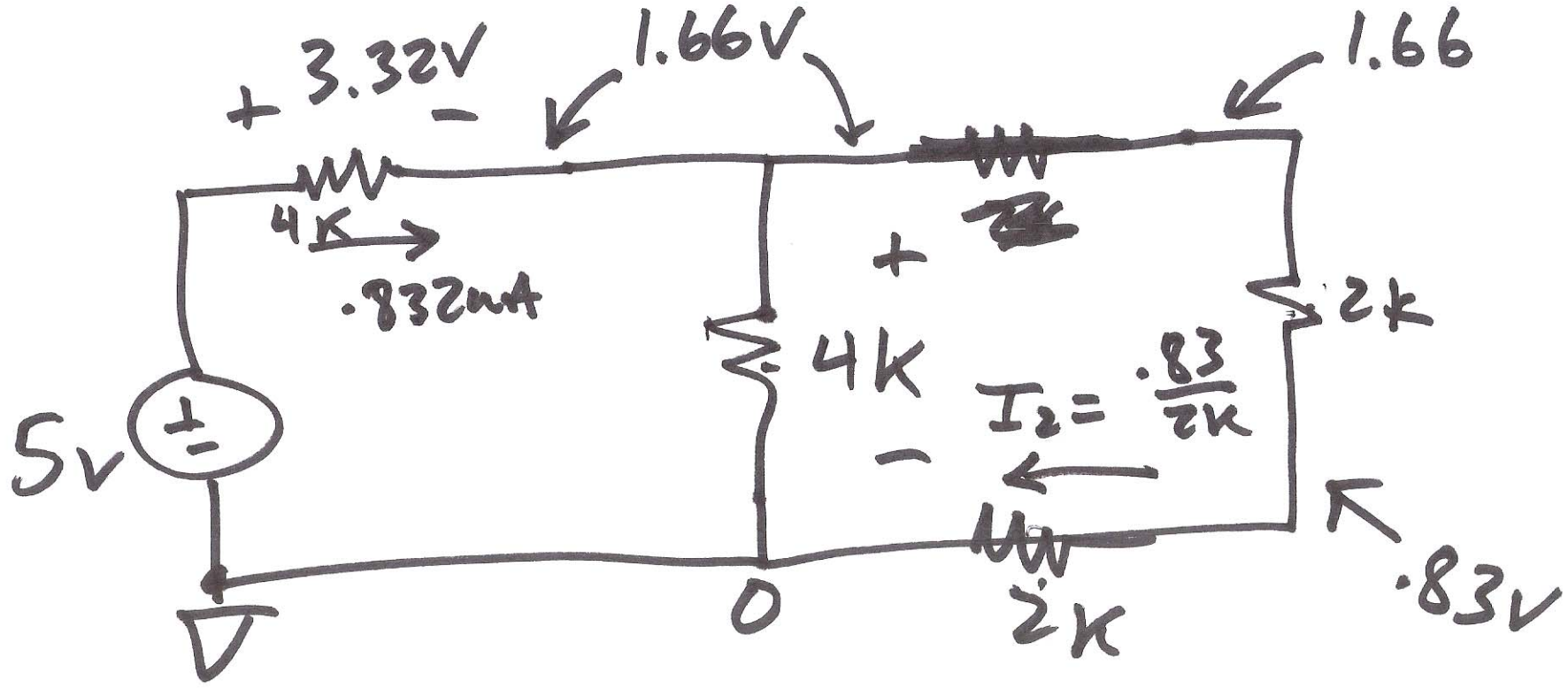
KVL around loop 2

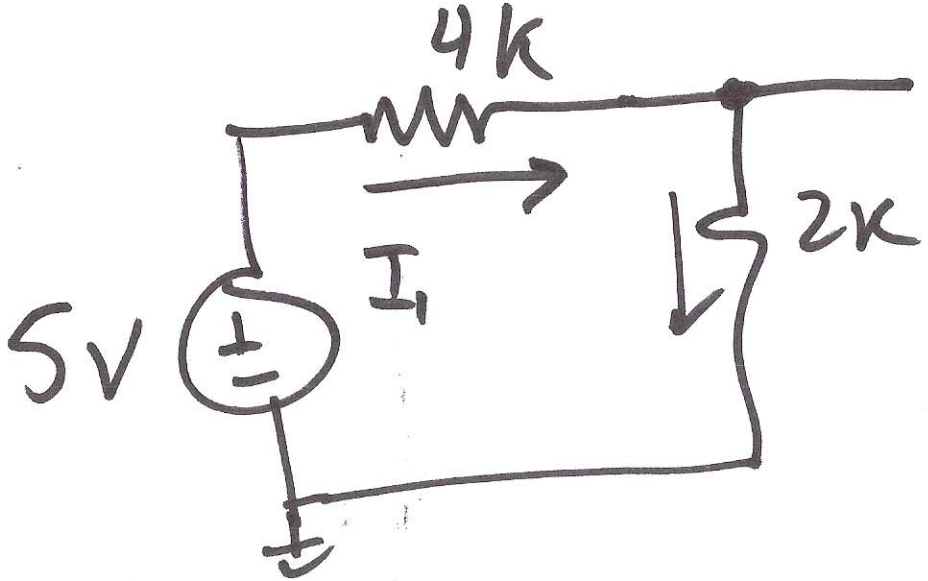
$$4k(I_1 - I_2) = 2k I_2 + 2k I_2 = 4k I_2$$

$$I_1 = 2I_2 \Rightarrow I_1 = .832mA\, I_2$$

$$5 = 4k \cdot 2I_2 + 4k(2I_2 - I_2)$$

$$5 = 12k\, I_2 \Rightarrow I_2 = \frac{5}{12k} = .416mA$$

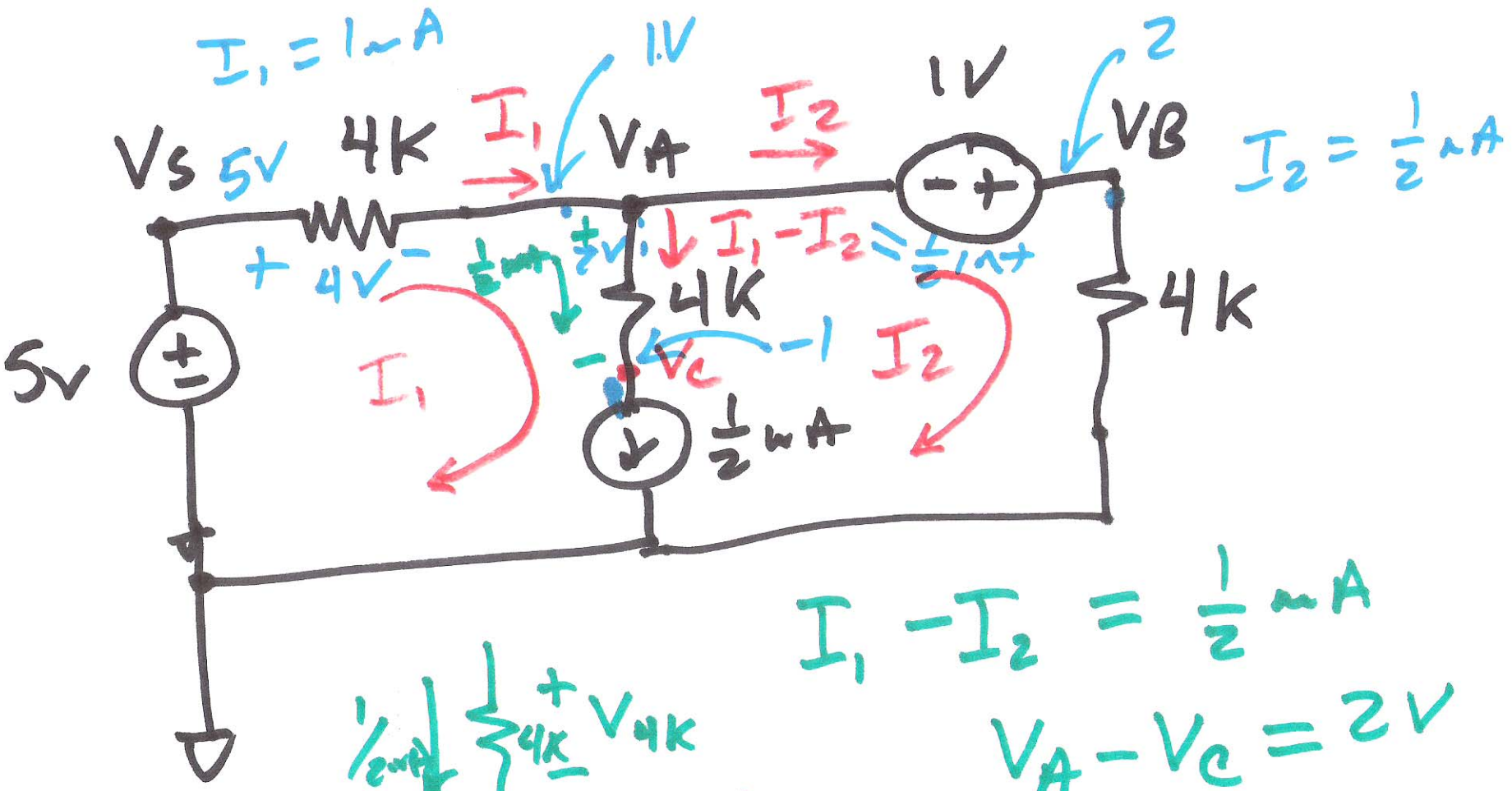


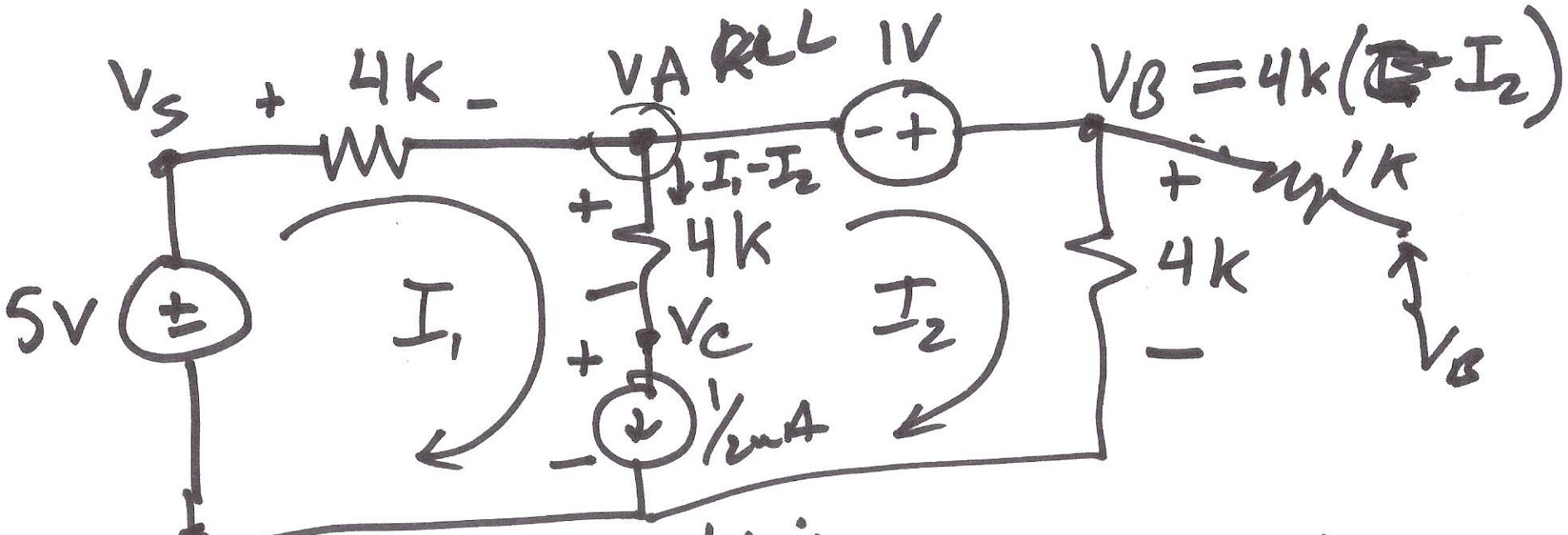


$$5 \cdot \frac{2K}{4K+2K} = 1.66V$$

$$I_1 = \frac{5 - 1.66}{4K} = .833 \text{ mA}$$

$$I_2 = .416 \text{mA}$$


$I_1 = 1mA$
1V
2
1V
Vs 5V
4K
I_1
VA
I_2
VB
$I_2 = \frac{1}{2}mA$
+ 4V −
$\frac{1}{2}mA$
2V
$I_1 - I_2 = \frac{1}{2}mA$
4K
4K
5V
I_1
V_C
I_2
$\frac{1}{2}mA$
$I_1 - I_2 = \frac{1}{2}mA$
$V_A - V_C = 2V$
$\frac{1}{2}mA$
4K
V_{4K}
$= 4K \cdot \frac{1}{2}mA$
$= 2V$



Mesh analysis

$$5 = 4k \cdot I_1 + 4k(I_1 - I_2) + V_C$$

5V

$$V_C + (I_1 - I_2)4k + 1 = 4k \cdot I_2$$

$$V_A - V_C = 4k \cdot (I_1 - I_2)$$

$$V_A = 4k \cdot I_2 - 1$$

$$4kI_2 - 1 - V_c = 4k(I_1 - I_2)$$

$$-V_c = 1 + 4k(I_1 - I_2) - 4kI_2$$

$$\boxed{-V_c = 1 + 4kI_1 - 8kI_2}$$

$$V_c = -1 - 4kI_1 + 8kI_2$$

$$5 = 4kI_1 + \cancel{4kI_1} - \cancel{4kI_2} - 1 - \cancel{4kI_1} + \overset{4}{\cancel{8}}kI_2$$

$$5 = 4k(I_1 + I_2) - 1$$

$$1.5mA = \frac{6}{4k} = I_1 + I_2$$

$$\boxed{I_1 = 1.5mA - I_2}$$

$$V_C + \frac{1}{2}mA \cdot 4K + 1 = 4K I_2$$

$$-1 - 4K I_1 + 8K I_2 + 3 = 4K I_2$$

$$2 = 4K(I_1 - I_2)$$

$$I_1 - I_2 = \frac{1}{2}mA$$

$$I_1 + I_2 = 1.5mA$$

$$\frac{1}{2}mA + I_2 + I_2 = 1.5mA$$

$$I_2 = \frac{1mA}{2} = \frac{1}{2}mA$$

$$I_1 = 1mA$$