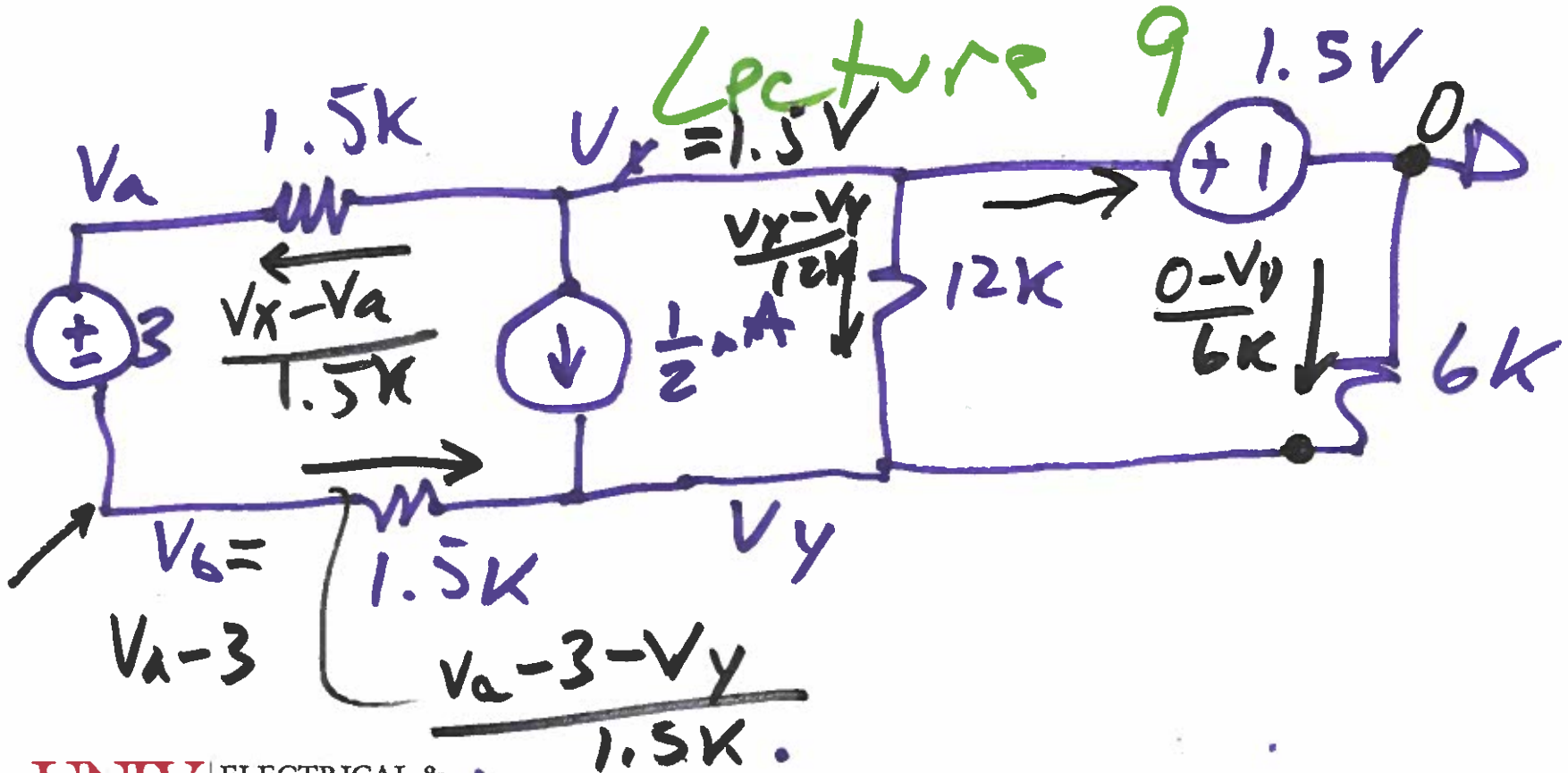


EE 220

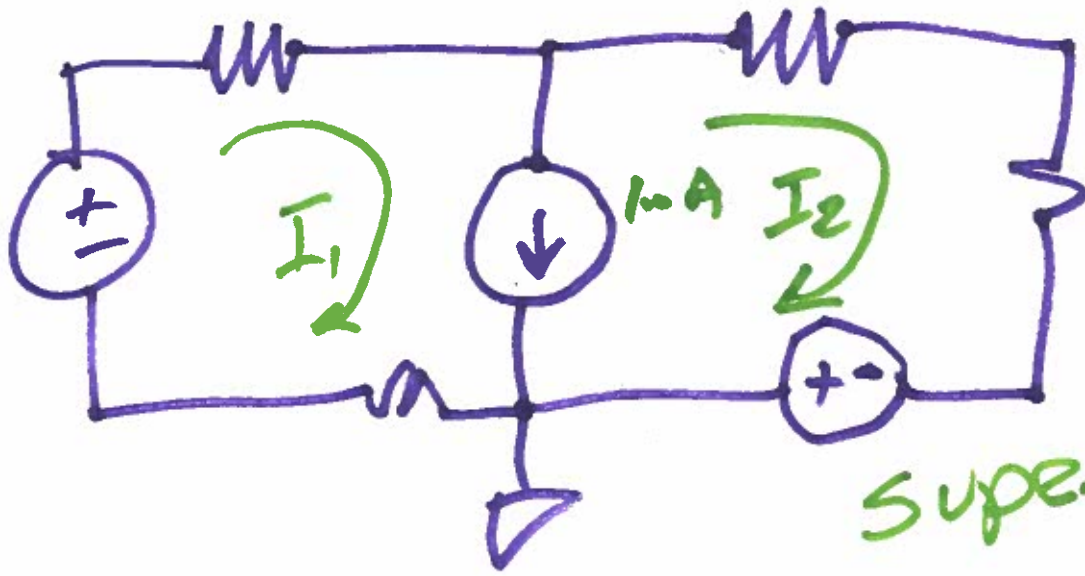
Circuits I

Sept. 25, 2019

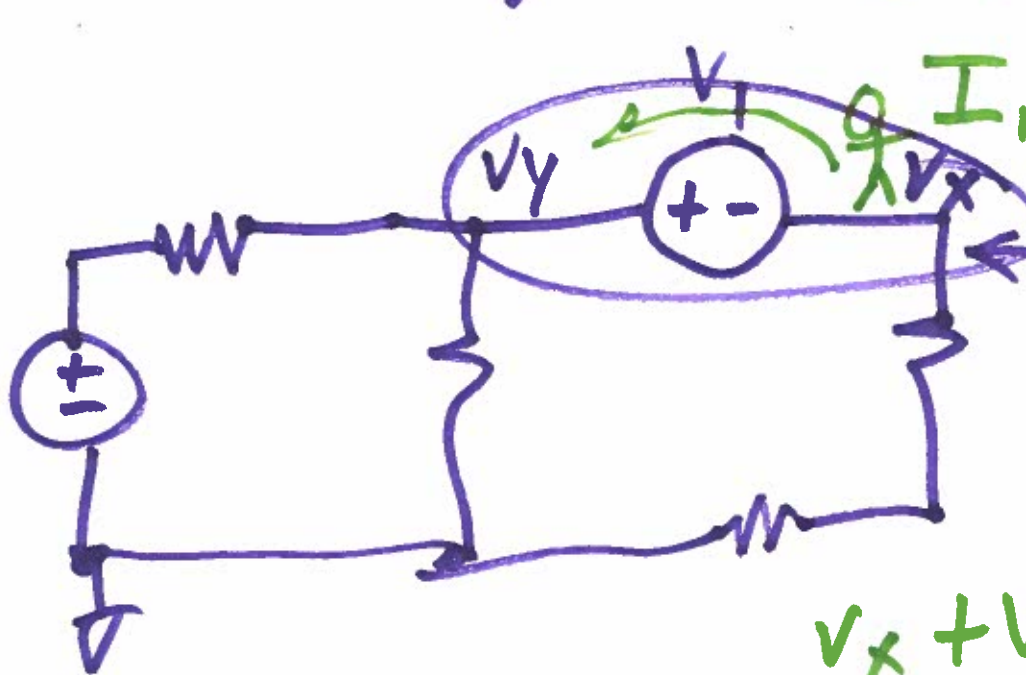
Lecture 9 1.5V



1)



super mesh



$$I_1 - I_2 = 1\text{mA}$$

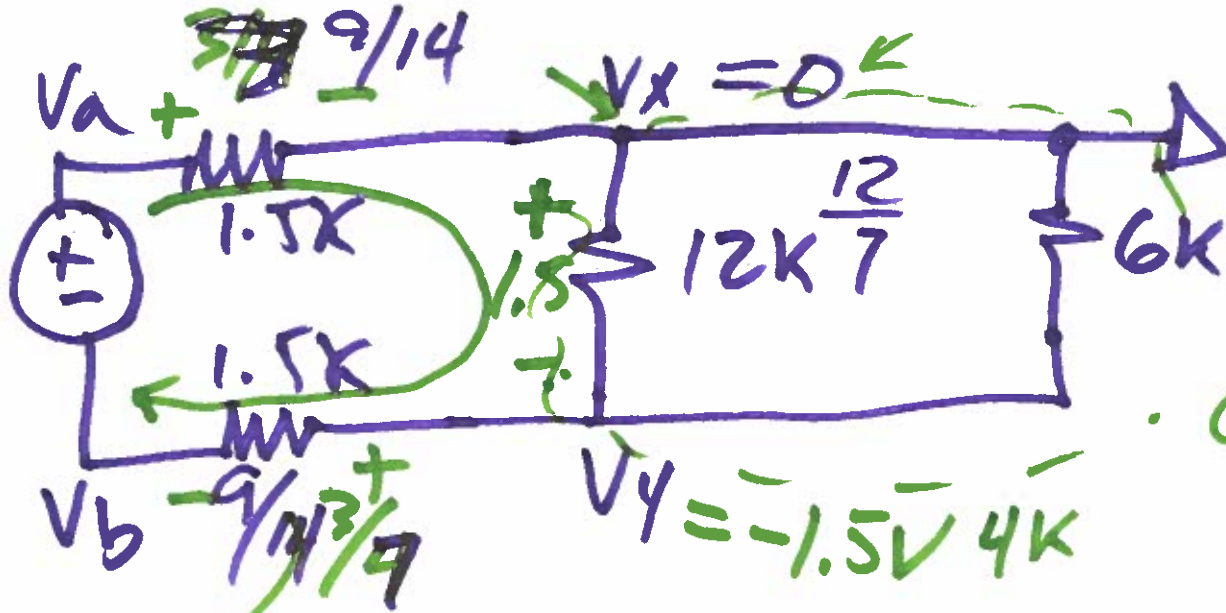
"super node"

$$V_y - V_x = V_1$$

$$V_x + V_1 = V_y$$

2)

3



$0 - V_y = 1.5V$

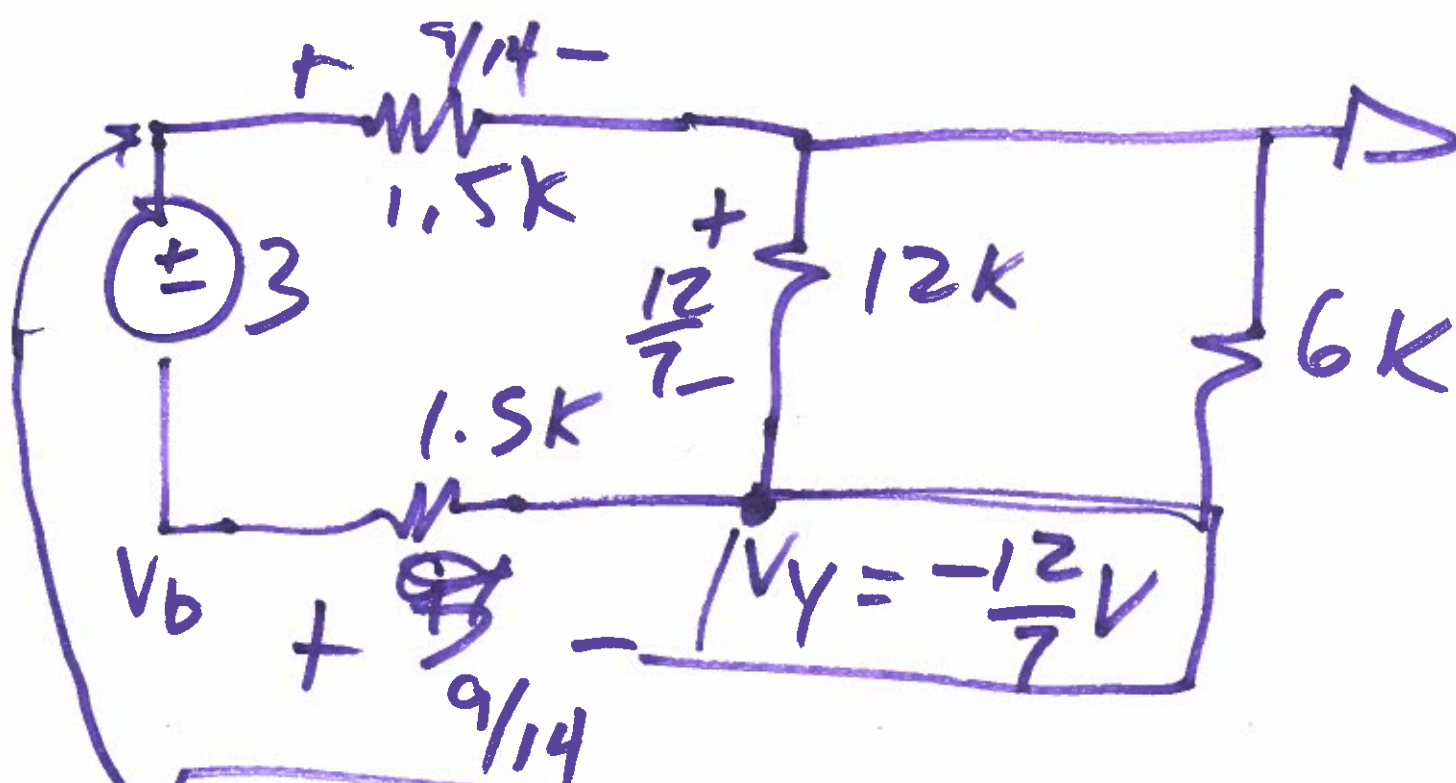
$V_y = -1.5V$

~~Va~~

$$\frac{3 \cdot 1.5k}{1.5k + 4k + 1.5k} = \frac{3 \cdot 1.5}{4 + 1.5} = \frac{3 \cdot 1.5}{7k}$$

$$\begin{aligned} \frac{3 \cdot 14}{14} - \frac{2 \cdot 9}{14} &= \frac{24}{14} = \frac{3 \cdot 3 \cdot \frac{1}{2}}{14 \cdot \frac{1}{2}} \\ &= \frac{12}{7} = \frac{9}{7} = \frac{9}{7} V \end{aligned}$$

3)



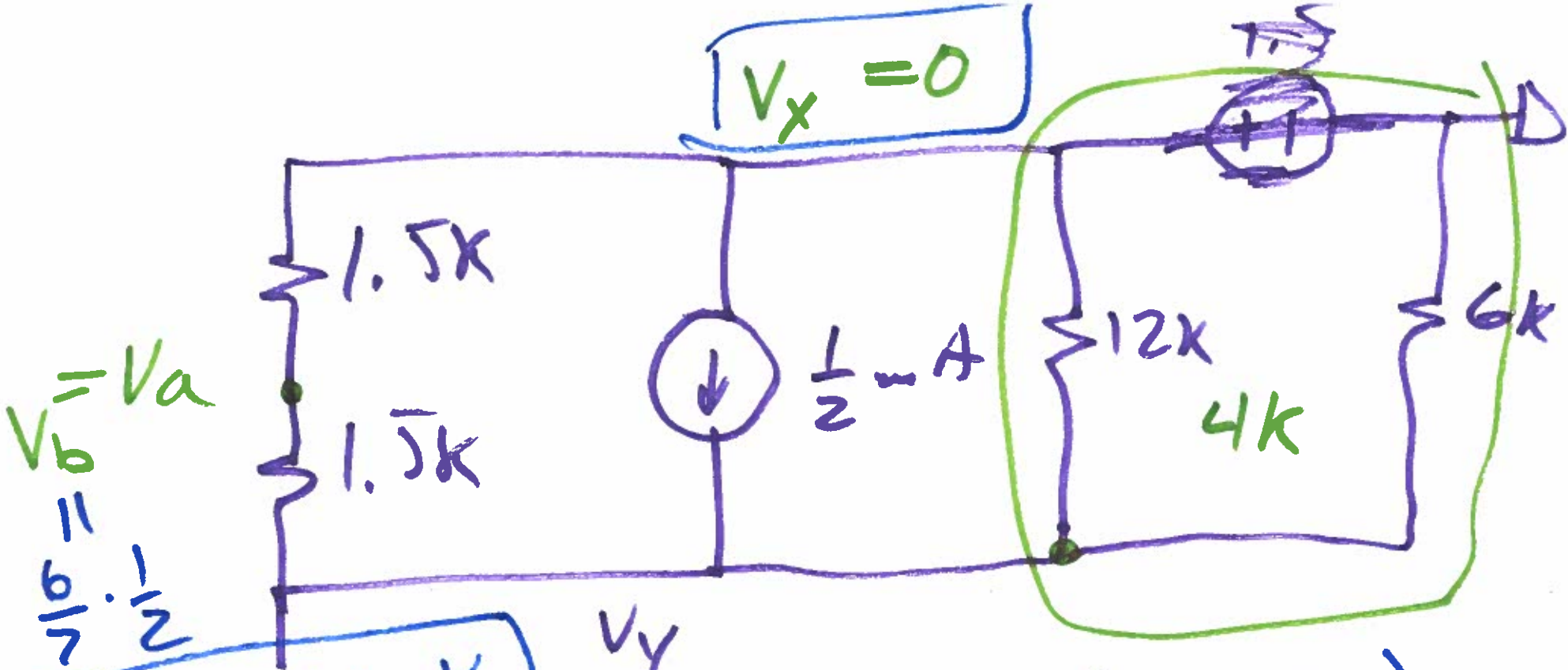
$$\frac{24}{14} + \frac{9}{14} + \frac{9}{14}$$

$$\frac{42}{14} = 3$$

$$V_a = \frac{9}{14} \text{ V}$$

$$V_b = \frac{9}{14} - \frac{42}{14} = -\frac{33}{14} \text{ V} = V_b$$

4)

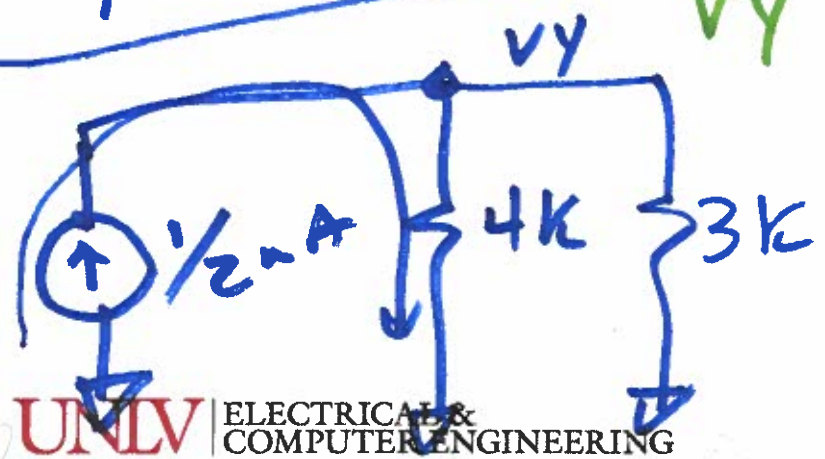


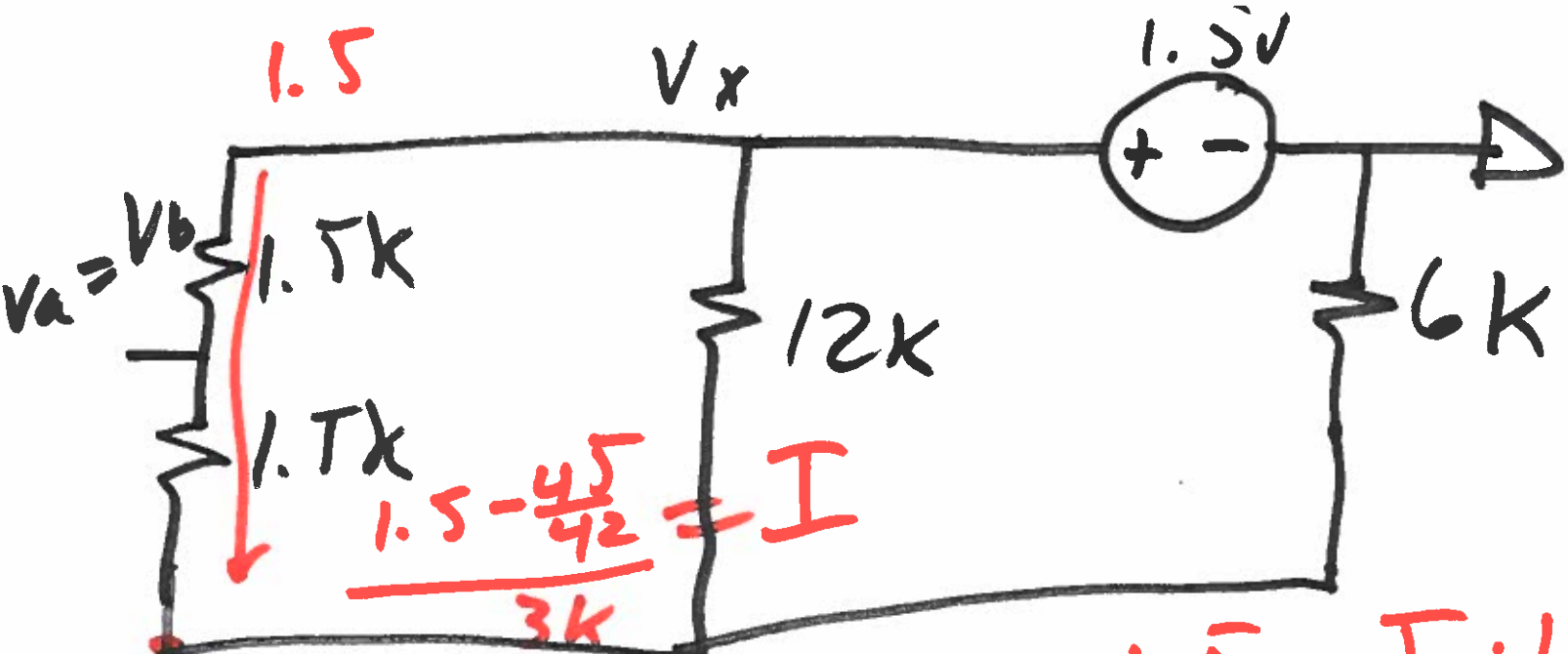
$V_b = V_a$
 $V_b = V_a \cdot \frac{1}{2}$

$= \frac{3}{7} V = V_b = V_a$

$V_Y = \frac{1}{2} A \cdot (4k \parallel 3k)$
 $= \frac{1}{2} A \cdot \frac{12k}{7} = \frac{12}{14} V$

$V_Y = \frac{6}{7} V$

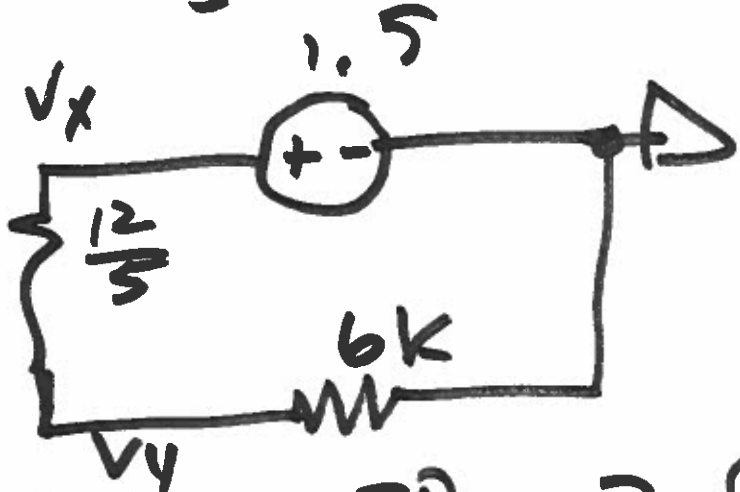




$$1.5 - I \cdot 1.5k = V_A = 4$$

$$\frac{\frac{45}{42} \cdot 3k \cdot 12k}{3k + 12k} = \frac{36k}{15} = \frac{12}{5} k\Omega = 2.4k$$

$$V_x = 1.5$$

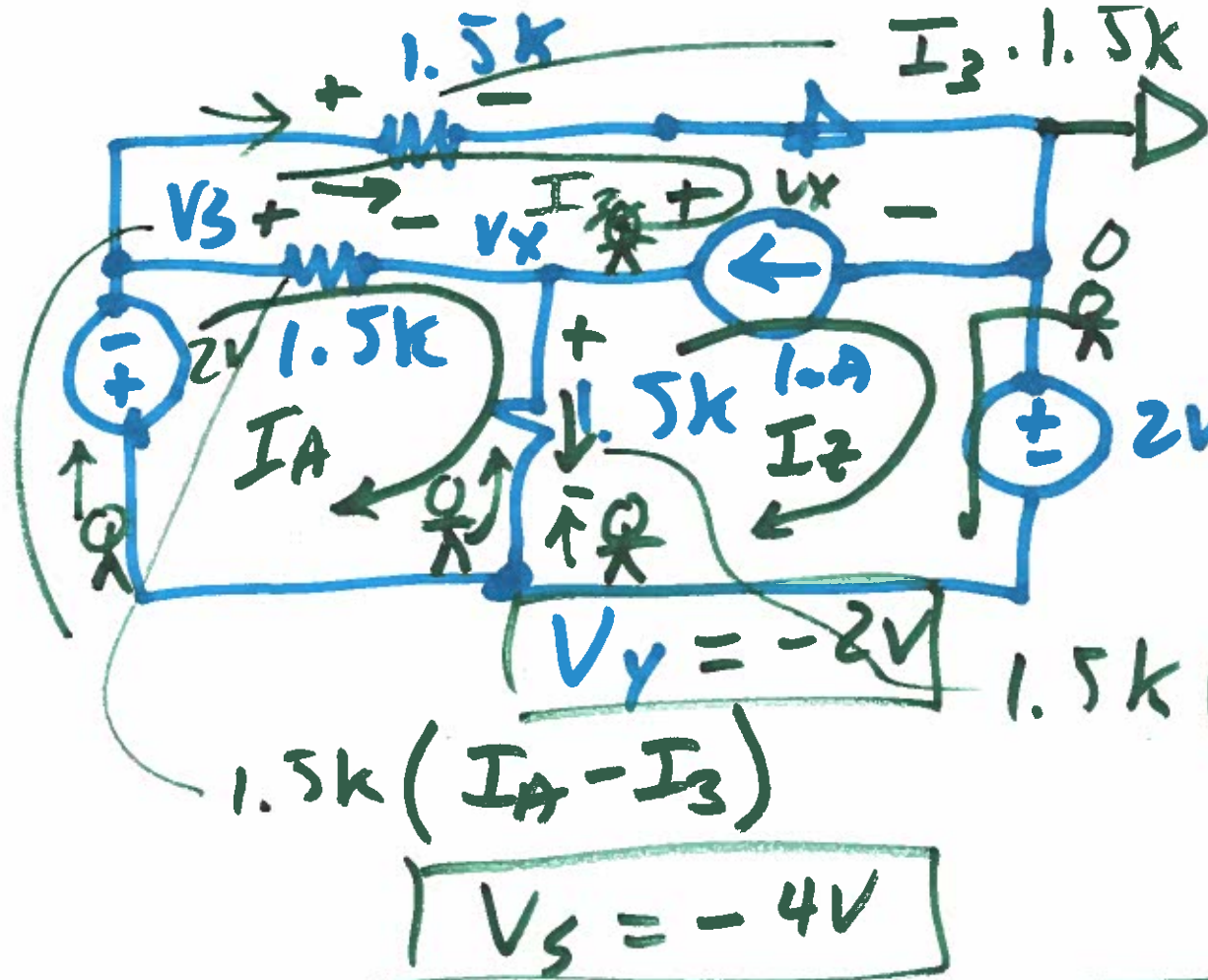


$$V_y = \frac{6}{6 + \frac{12}{5}} \cdot 1.5$$

$$= \frac{\frac{30}{5}}{\frac{30}{5} + \frac{12}{5}} \cdot 1.5$$

$$\frac{30}{42} \cdot \frac{3}{2} = \frac{45}{42} = V_y$$

b)



$$I_3 - I_2 = 1 \text{ mA} \quad \text{super-mesh}$$

$$-2 - 2 - I_3 \cdot 1.5k = 0$$

$$I_3 = \frac{-4}{1.5k}$$

$$1.5k(I_A - I_2) = -\frac{4}{1.5} \mu\text{A}$$

$$\frac{I_3}{I_3} = \dots$$

$$V_y = -2V$$

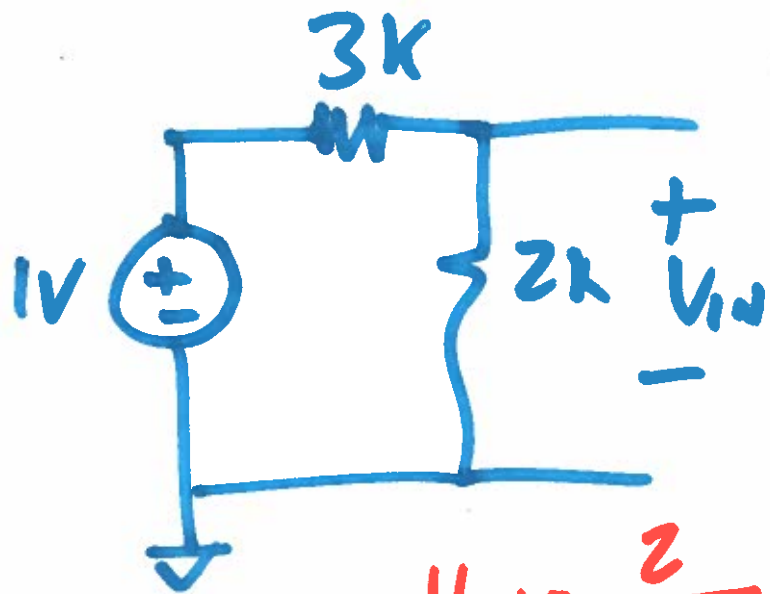
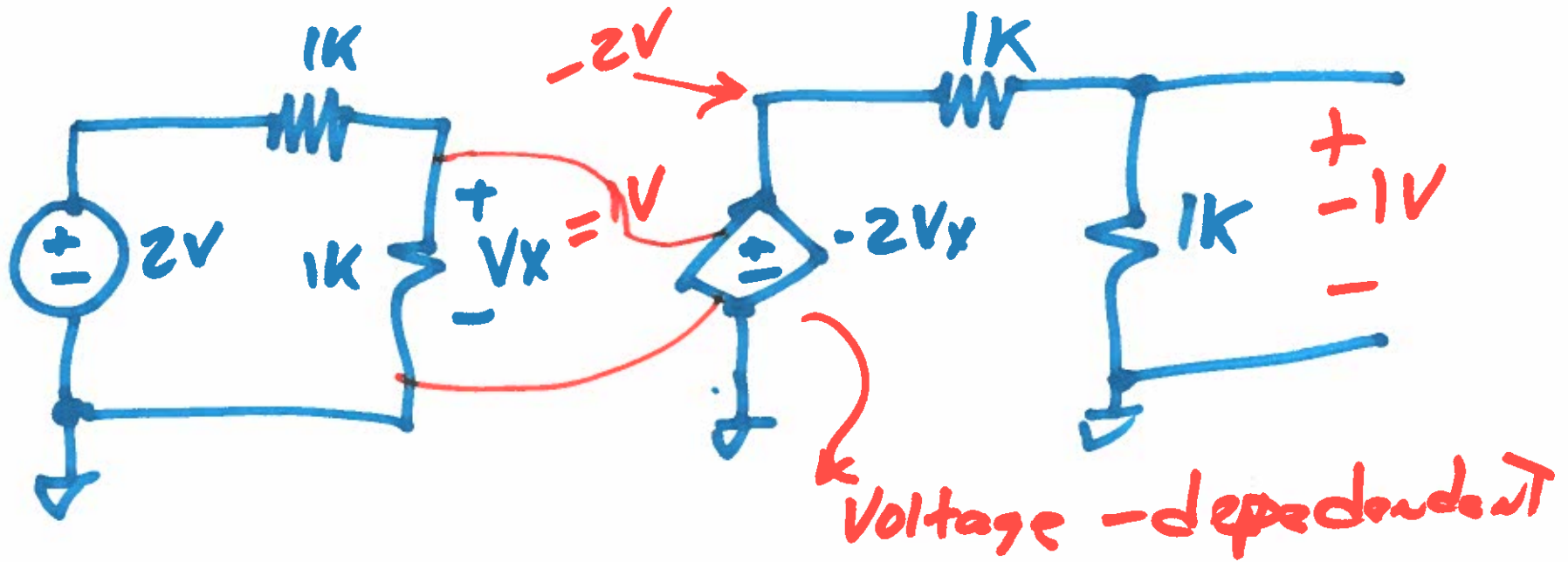
$$V_s = -4V$$

$$\textcircled{A} \quad 1.5k(I_A - I_2) + 1.5k(I_A - I_3) + 2 = 0$$

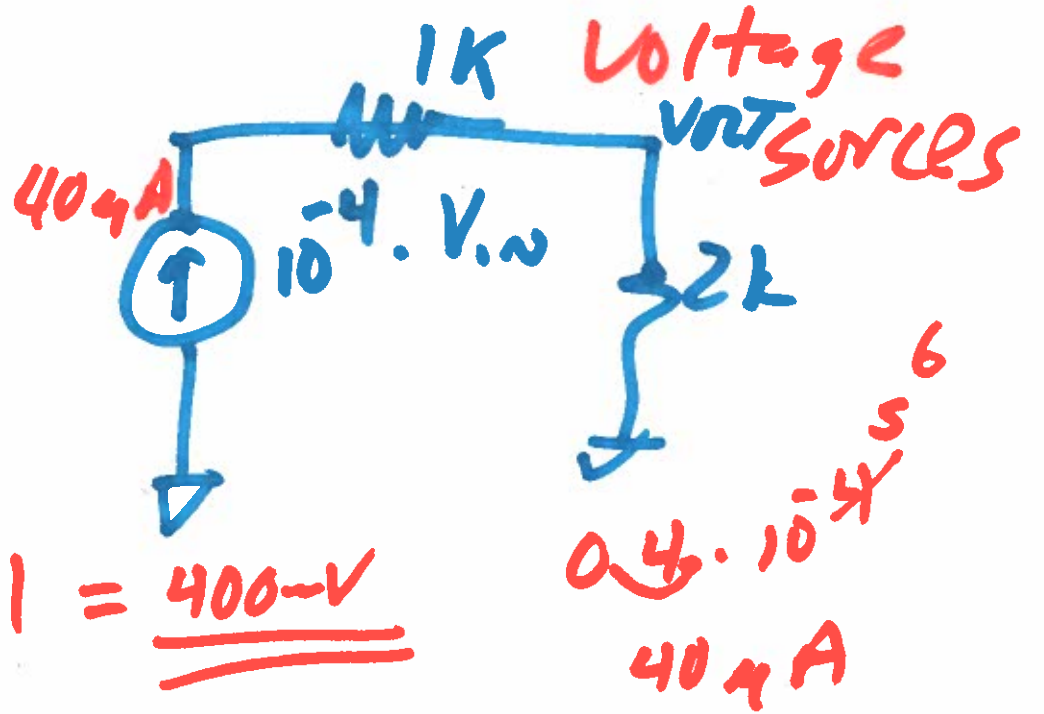
$$\textcircled{B} \quad 1.5k(I_A - I_2) - V_x - 2 = 0$$

$$\textcircled{C} \quad V_x + 1.5k(I_A - I_3) - I_3 \cdot 1.5k = 0$$

7)



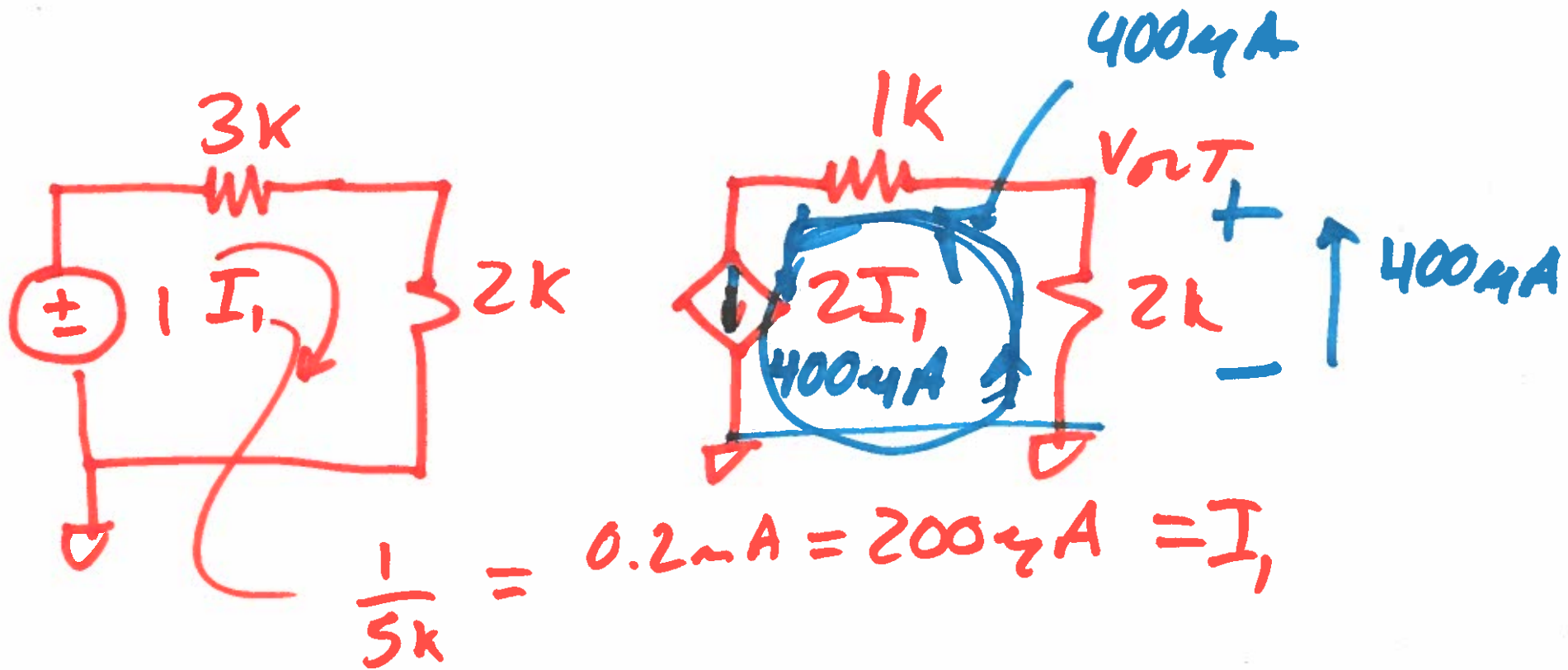
$$V_{1D} = \frac{2}{2+3} \cdot 1 = \underline{\underline{400mV}}$$



$$V_{0T} = 2K \cdot 40\mu A$$

$$\underline{\underline{V_{0T} = 80mV}}$$

8)



$$V_{OLT} = -400\mu A \cdot 2k = \underline{\underline{-800mV}}$$

$$V \downarrow \begin{matrix} + \\ - \end{matrix} = IR \quad \uparrow \begin{matrix} + \\ - \end{matrix} = -IR$$