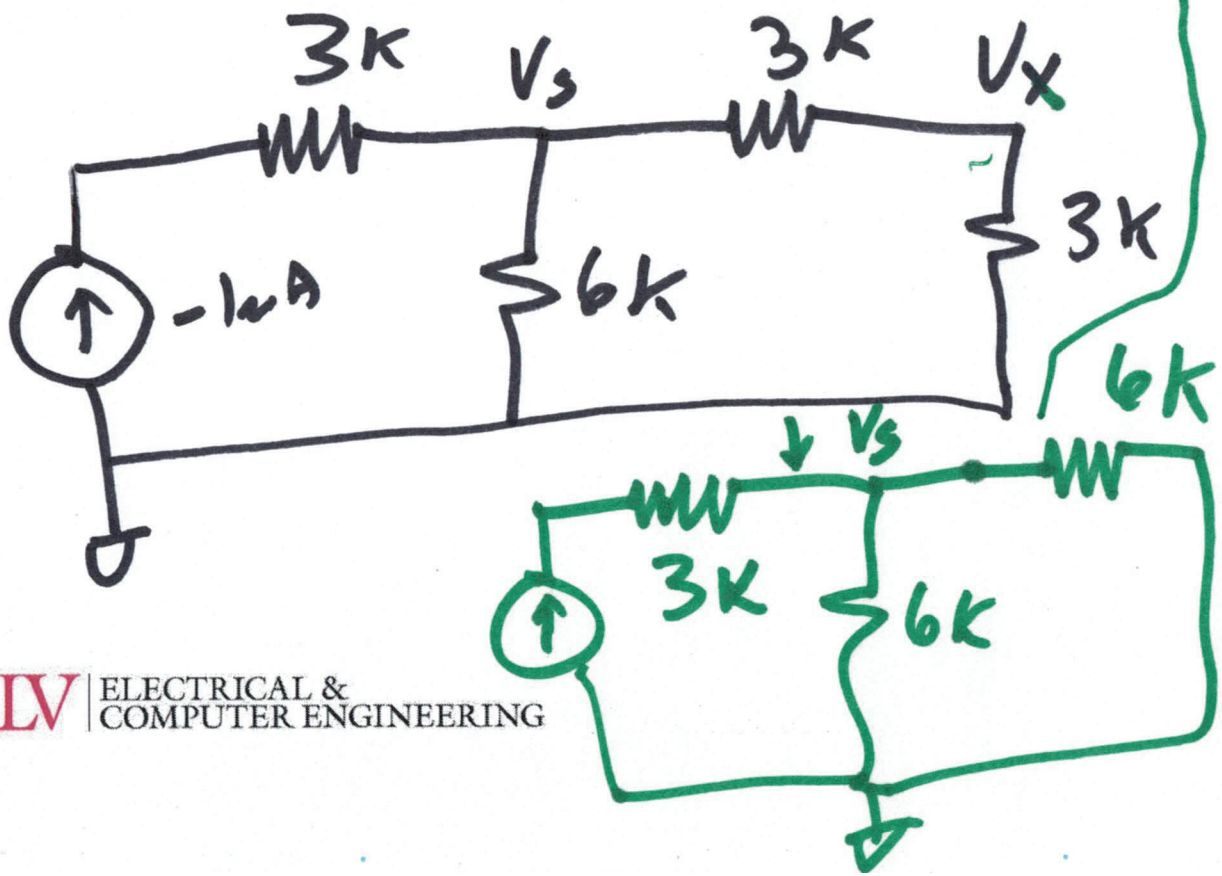
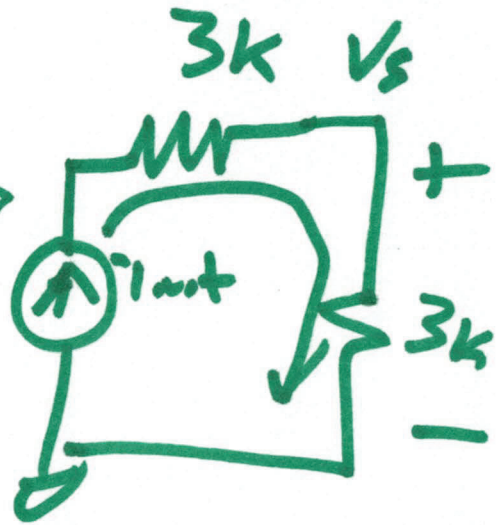
EE 220
Circuits 1
Sept. 14, 2020
Lecture 6





$V_S = (-1mA)\,3k$

$V_S = -3V$

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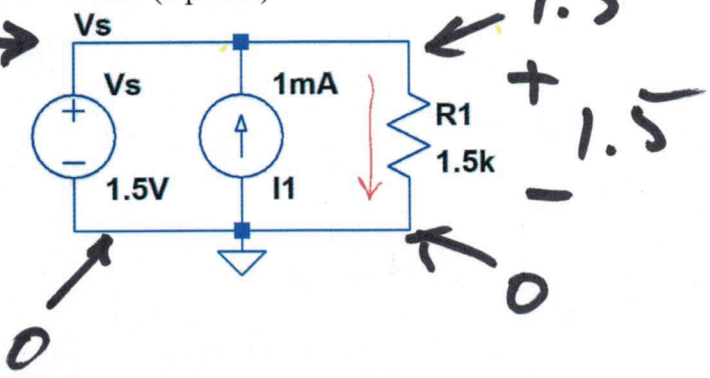
Closed book and notes.

Show your work for credit and **place a box around each of your answers.**

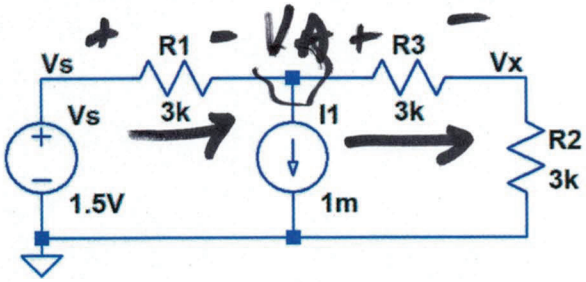
1. Determine the current through R1 in the direction indicated. Again, show your work for credit. (2 points)



1.5 → 1.5 + 1.5 − 0 → 0

$$I = \frac{1.5V}{1.5K} = 1mA$$

2. Find Vx in the following circuit. (5 points)



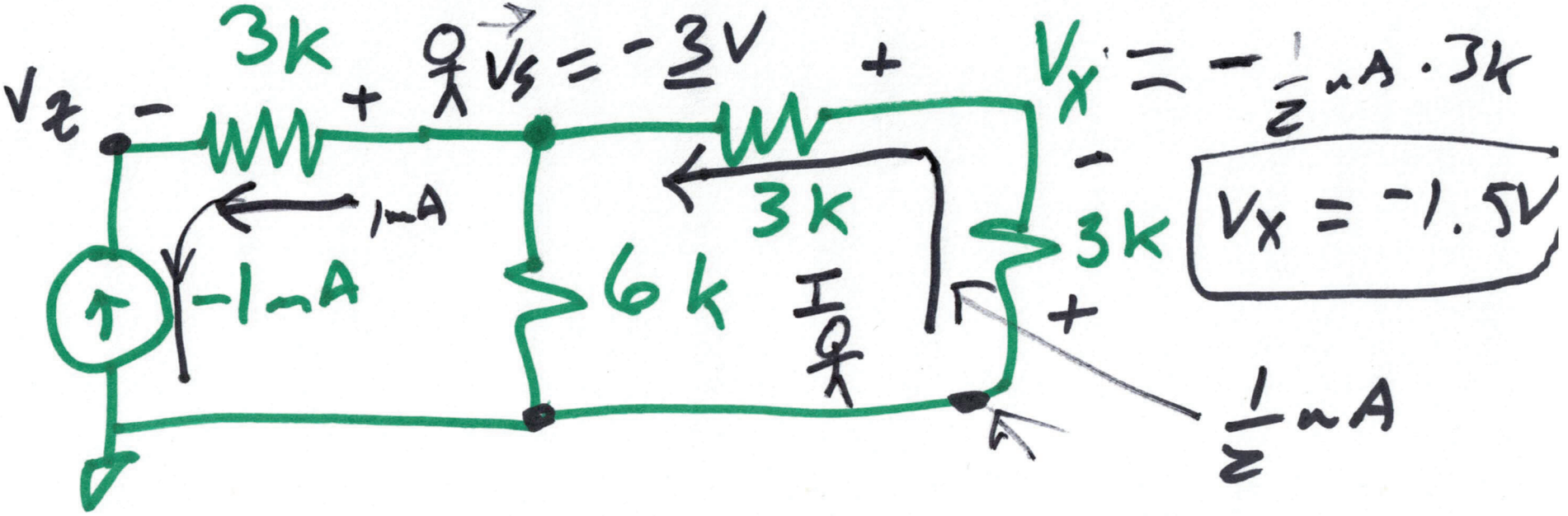
$$\frac{1.5 - V_A}{3K} = 1mA + \frac{V_A}{6K}$$

$$3 - 2V_A = 6 + V_A$$

$$-3 = 3V_A$$

$$V_A = -1\,V$$

2)

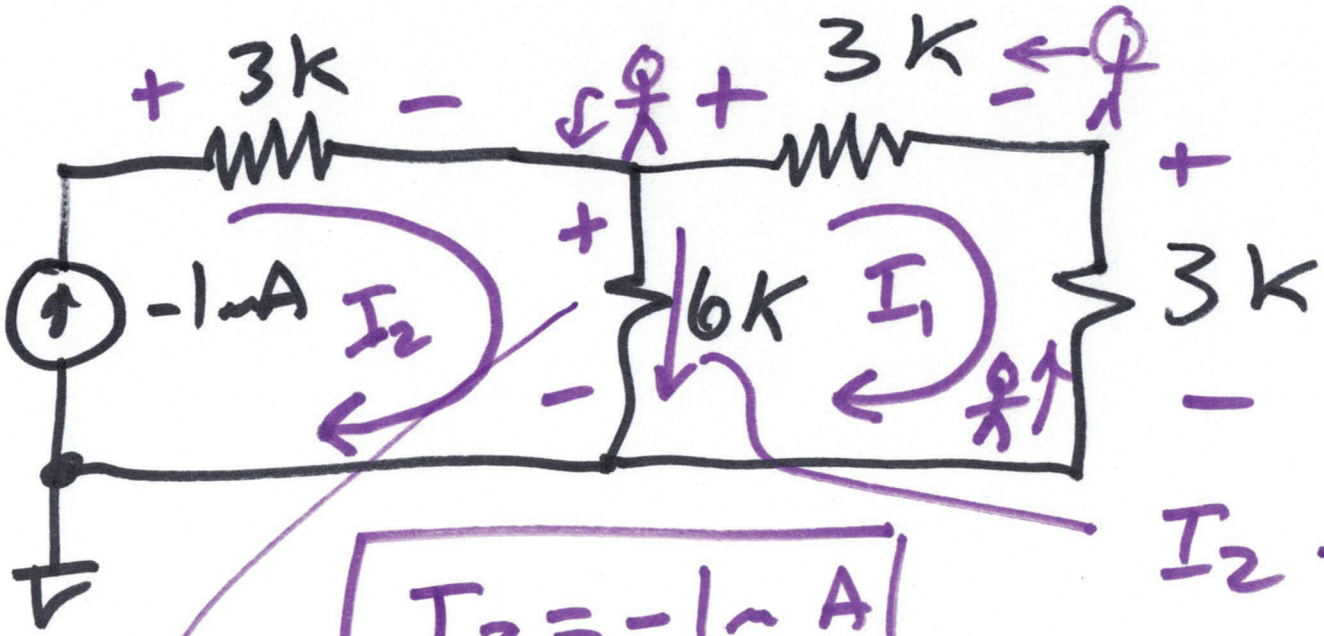


$$-3V - 3k \cdot 1mA = \boxed{V_z = -6V}$$

$$-3V + 3k \cdot I + 3k \cdot I = 0$$

$$6kI = 3$$

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



$I_2 = -1\,mA$

$6k \cdot (I_2 - I_1)$

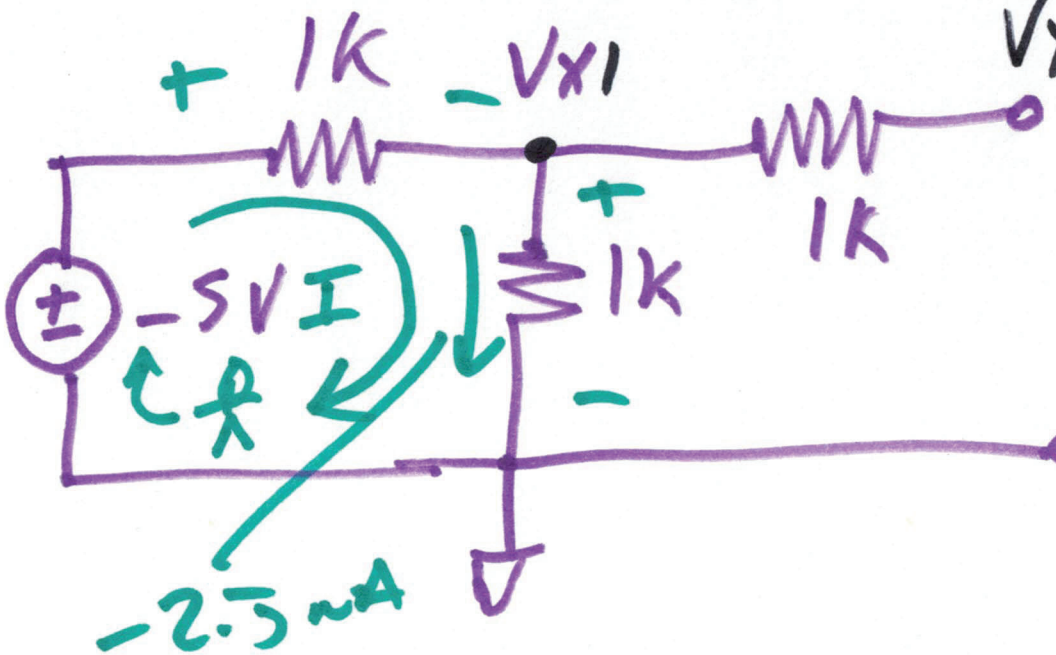
$I_1 = -\frac{1}{2}\,mA$

$$-6k(I_2 - I_1) + 3k \cdot I_1 + 3k \cdot I_1 = 0$$

$$6V + 6kI_1 + 3kI_1 + 3kI_1 = 0$$

$$6 = -12kI_1$$

4)



$V = IR$

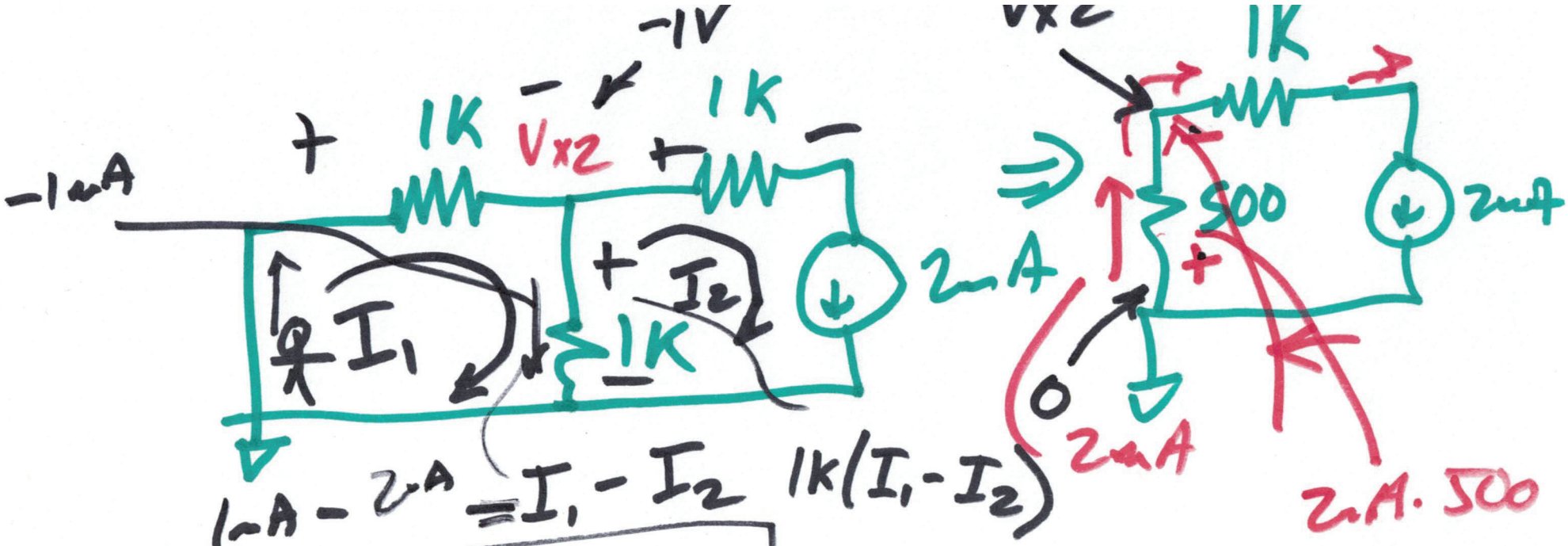
$$V_{x1} = -5 \cdot \frac{1K}{1K + 1K}$$

$$V_{x1} = -2.5V$$

$$-5 - 1K \cdot I - 1K \cdot I = 0, \quad I = -2.5mA$$

$$V_{x1} = -2.5mA \cdot 1K$$

$$V_{x1} = -2.5V$$



$1mA - 2mA = I_1 - I_2 \quad 1k(I_1 - I_2)$

$2mA \cdot 500 = 1V$

$I_2 = 2mA$

$V = IR$

$-1K I_1 - 1k(I_1 - I_2) = 0$

$I_1 \cdot 2K = 2V$

$I_1 = 1mA$

$0 - V_{x2} = 1V$

$-1K I_1 - 1K I_1 + 2V = 0$

$V_{x2} = -1V$

I_1

$V_x = V_{x1} + V_{x2}$

$-3.5V = -2.5 + -1$

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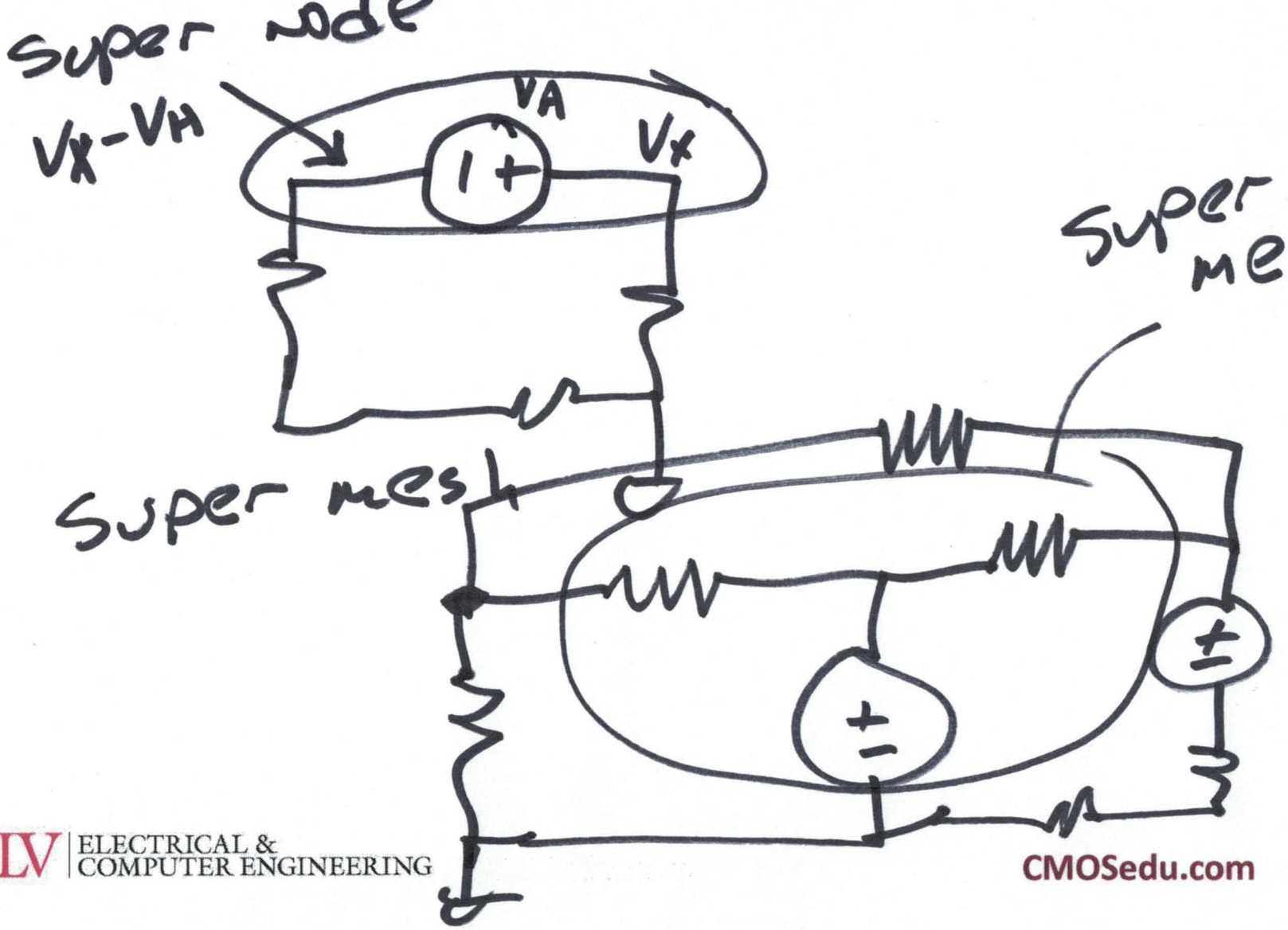
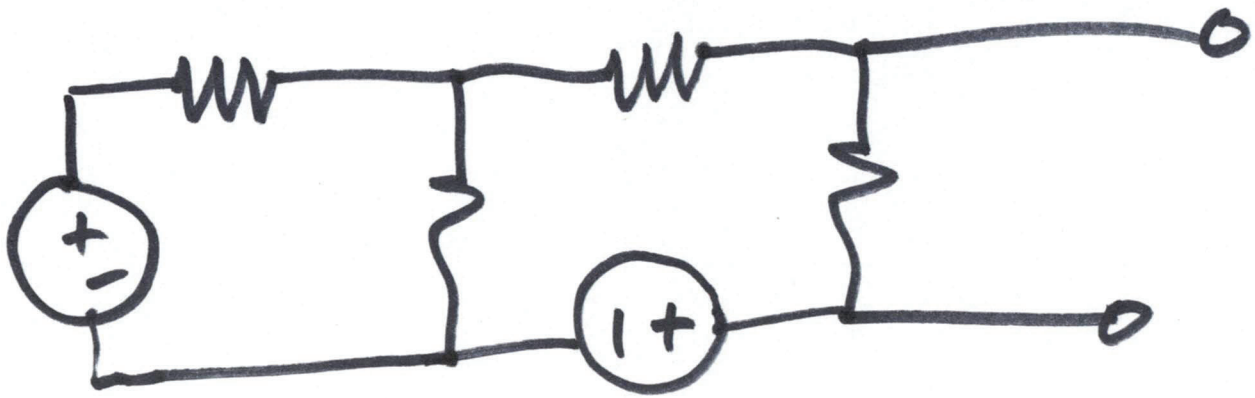
6)

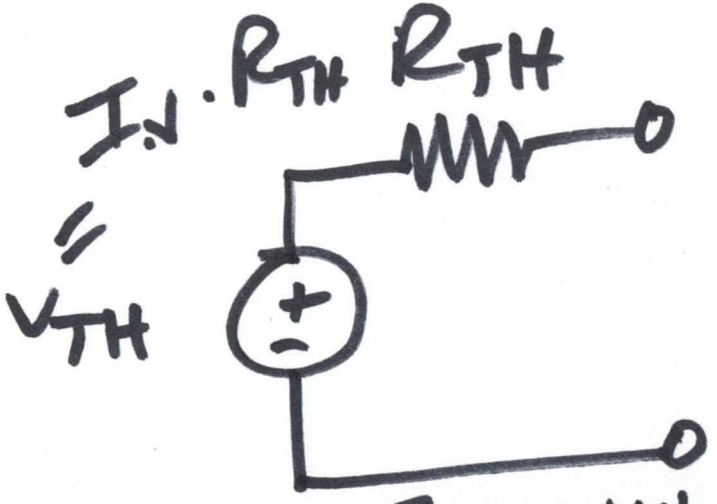
Ohm's Law, Kirchhoff's voltage law (KVL)

Kirchhoff's current law (KCL)

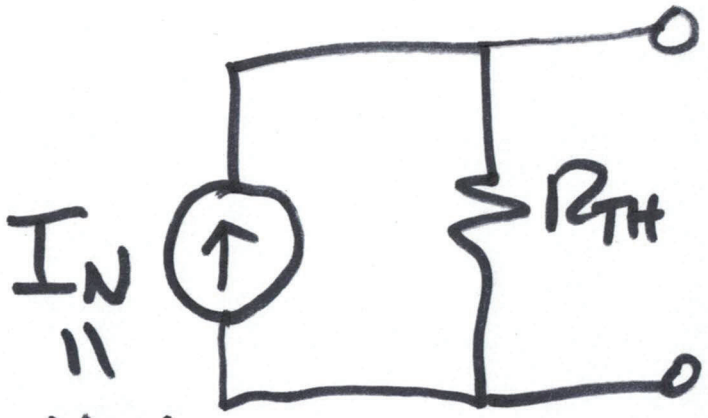


Thevenin equivalent





Thevenin equivalent

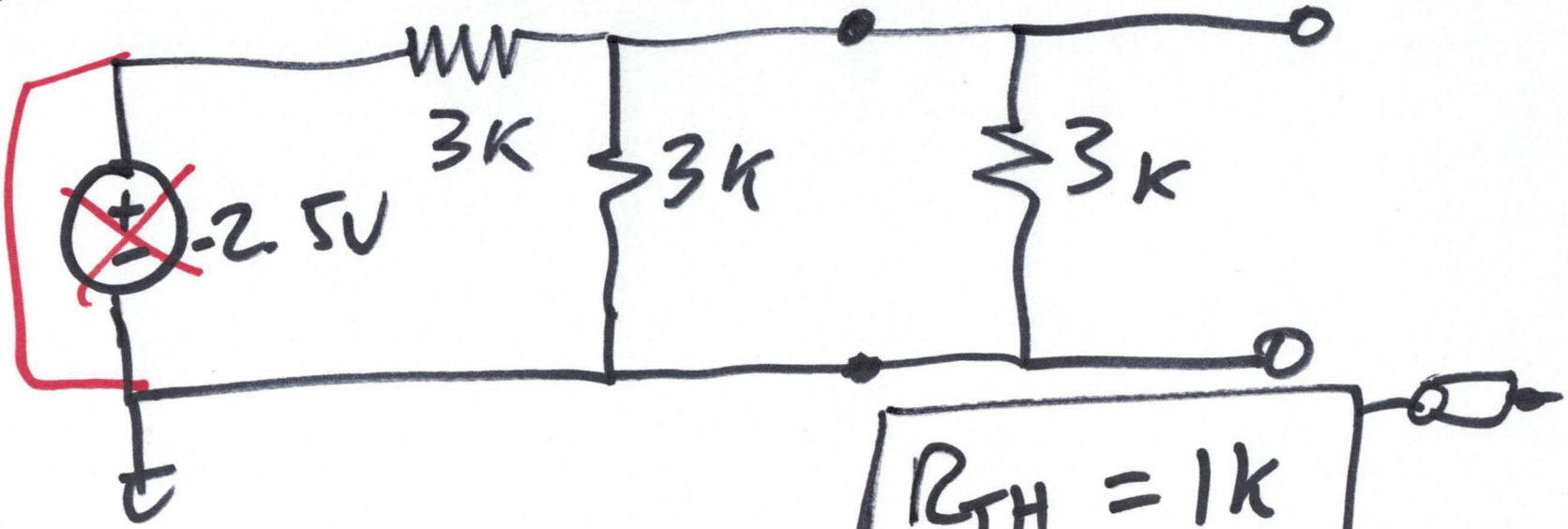


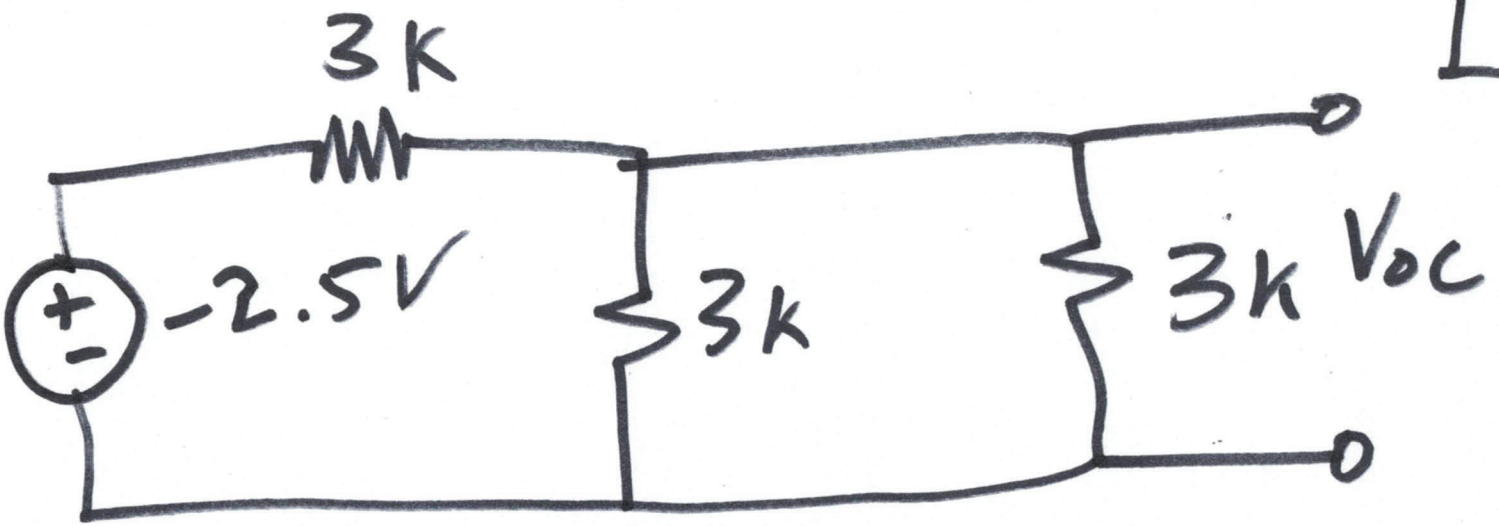
$I_N \cdot R_{TH} \; R_{TH}$

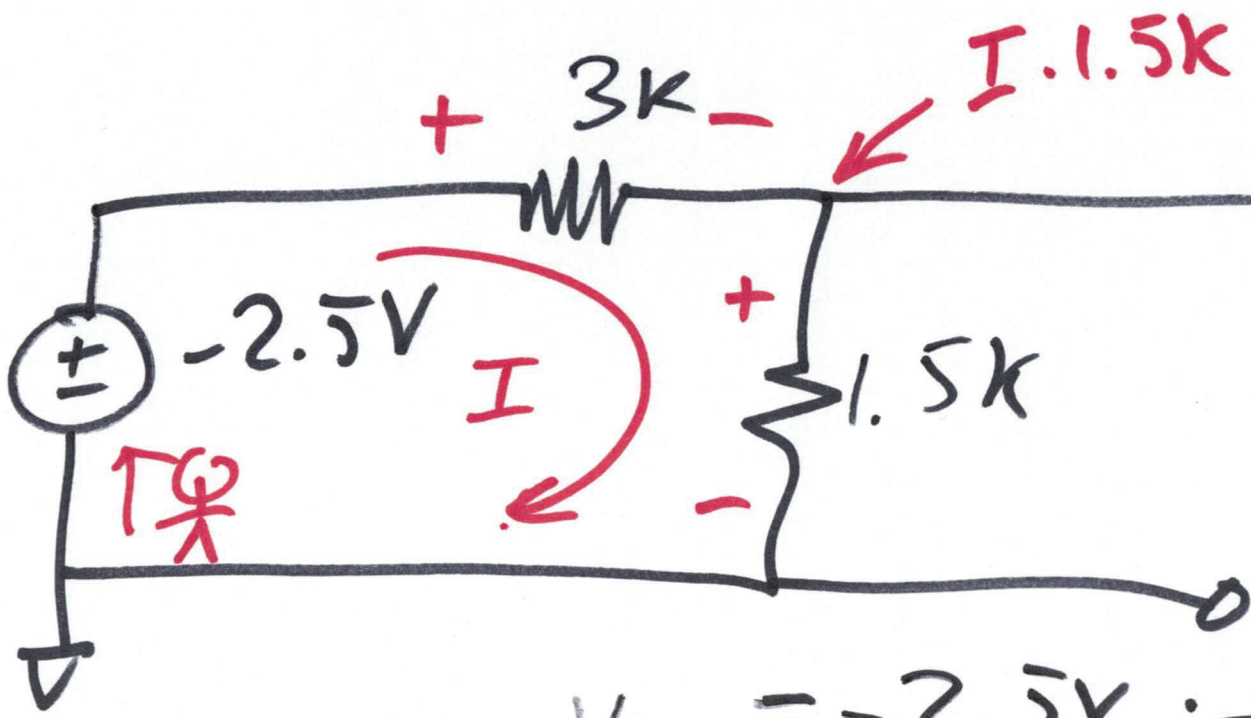
$= V_{TH}$

$I_N = \frac{V_{TH}}{R_{TH}}$

3(a)







$$V_{oc} = -2.5V \cdot \frac{1.5k}{1.5k + 3k}$$

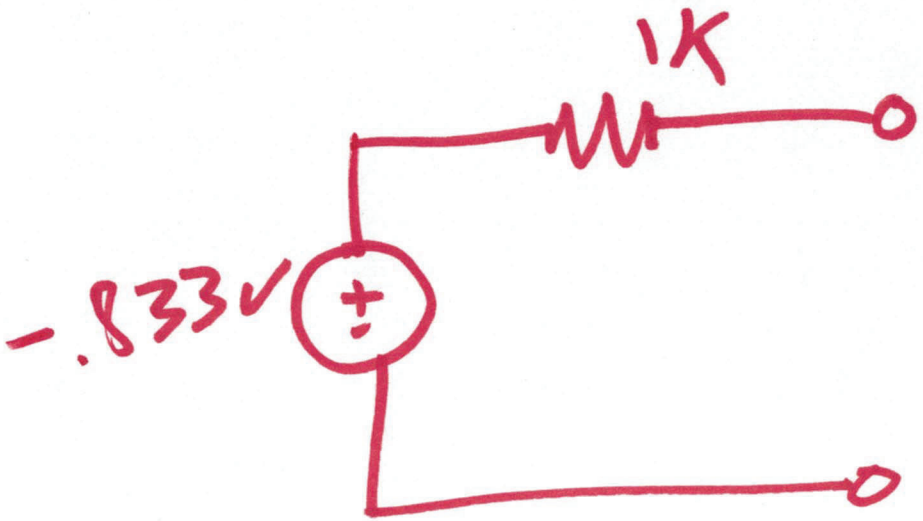
$$-2.5V - I \cdot 3k - I \cdot 1.5k = 0$$

$$= -2.5 \cdot \frac{3}{3+6} \qquad \frac{3}{9} = \frac{1}{3}$$

$$-2.5 = I \cdot 4.5k$$

$$I = \frac{-2.5}{4.5} \sim -5/9 \text{ A}$$

$$\boxed{V_{oc} = \frac{-2}{3}} = -.833V$$


1K
-.833V