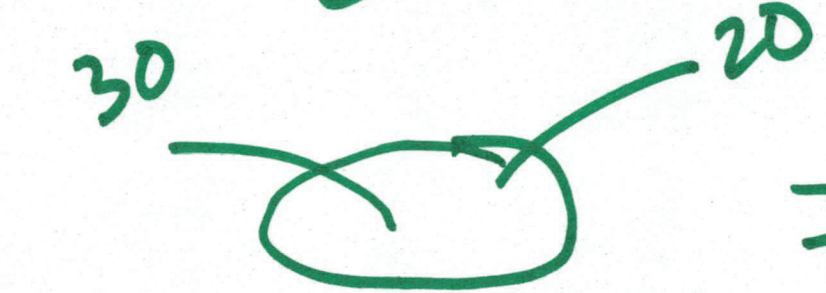
EE 221 Circuits II

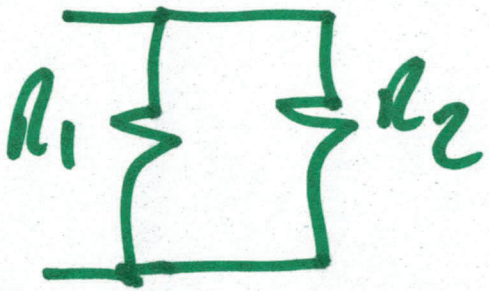
January 25, 2021

Lecture 2



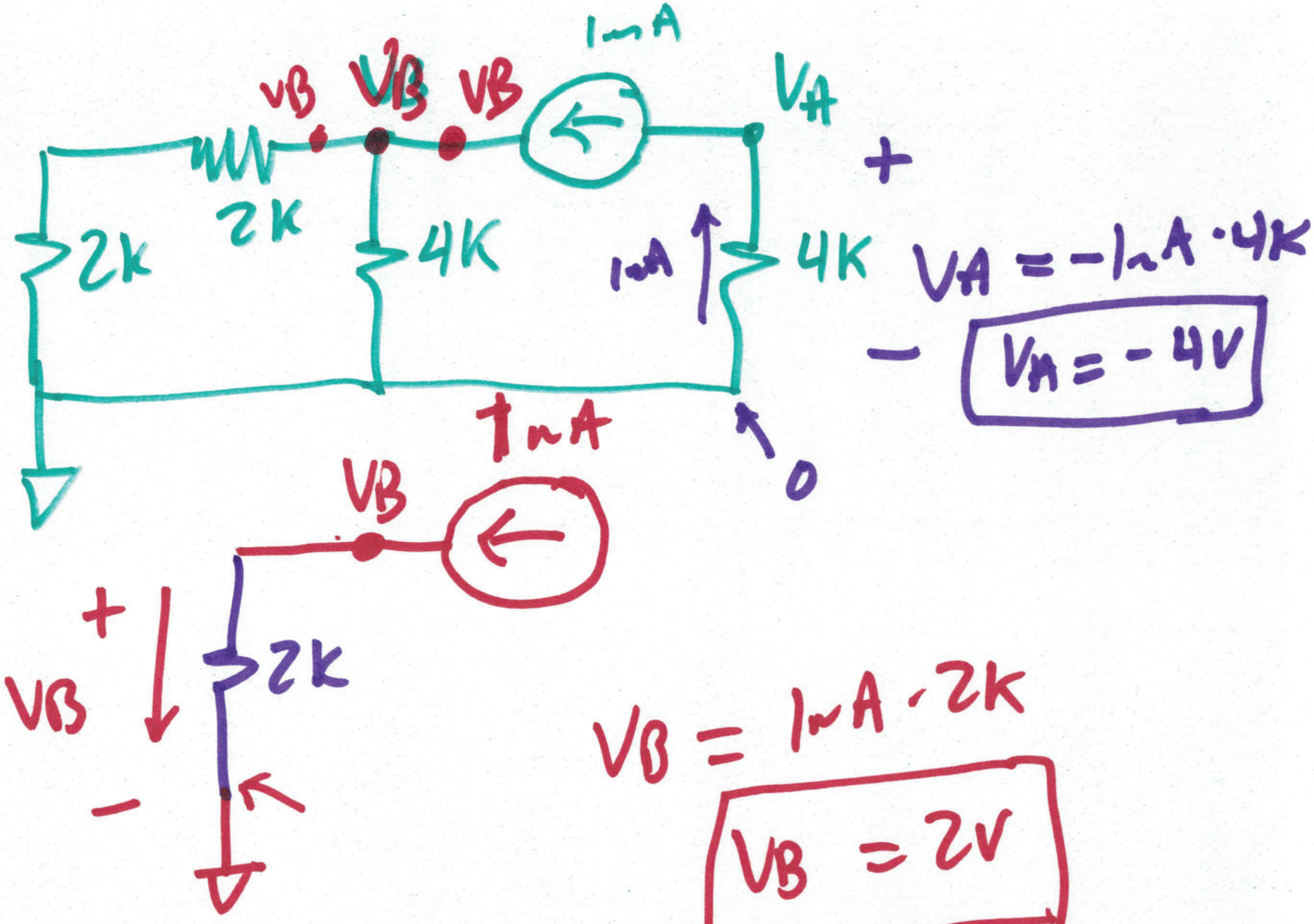
$$\frac{1}{T} = \frac{1}{20} + \frac{1}{30}$$

$$T = \frac{20 \cdot 30}{20 + 30}$$



$$\rightarrow \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_T = \frac{R_1 R_2}{R_2 + R_1}$$

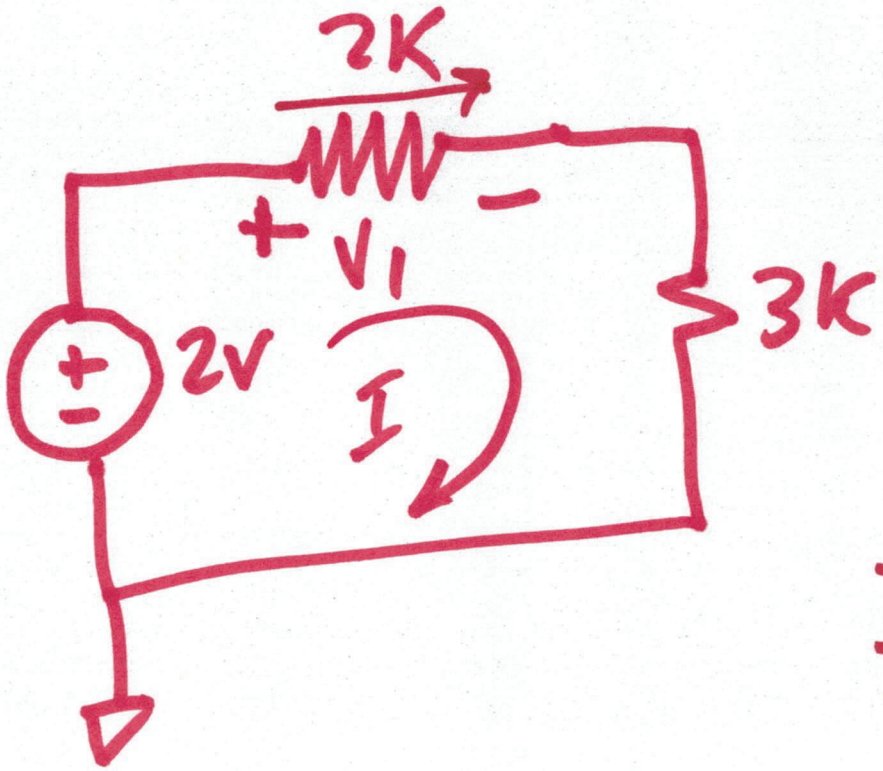


$$V_A = -1mA \cdot 4K$$

$$V_A = -4V$$

$$V_B = 1mA \cdot 2K$$

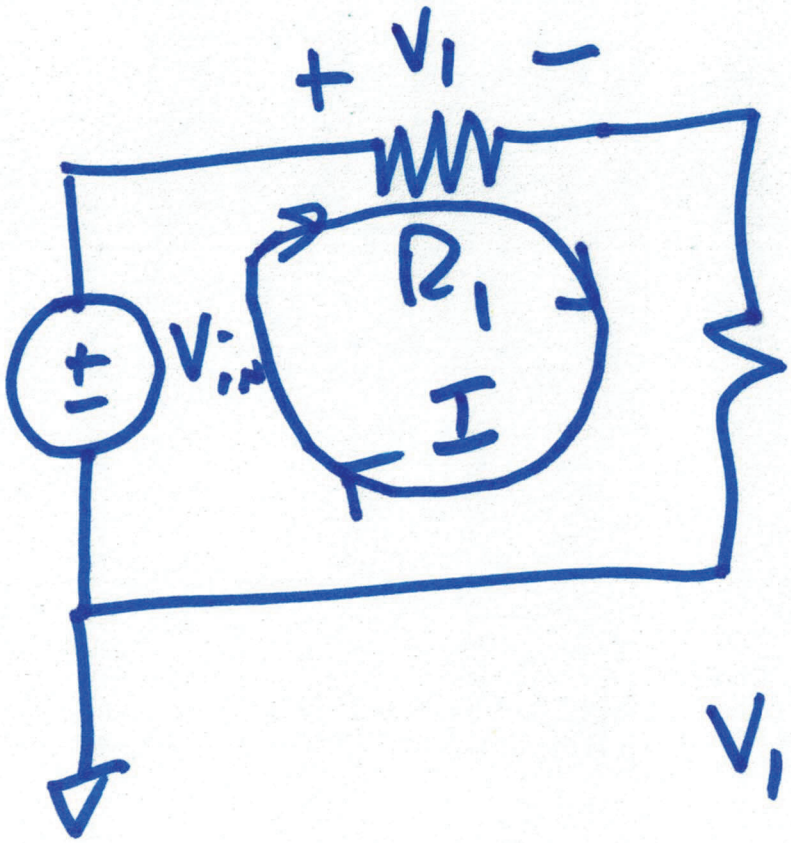
$$V_B = 2V$$

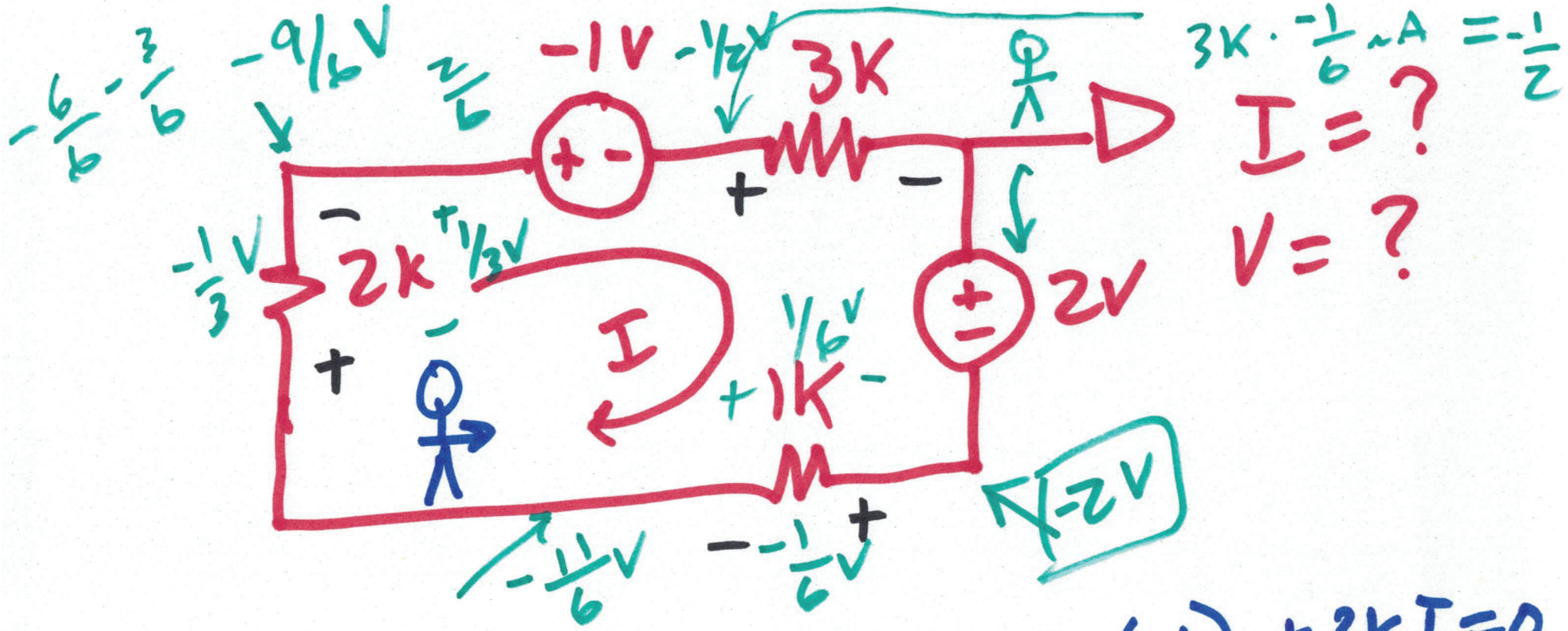


$$V_1 = 2 \cdot \frac{2k}{2k+3k}$$

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

$$V_1 = 2k \cdot I = 2 \cdot \frac{2k}{2k+3k}$$

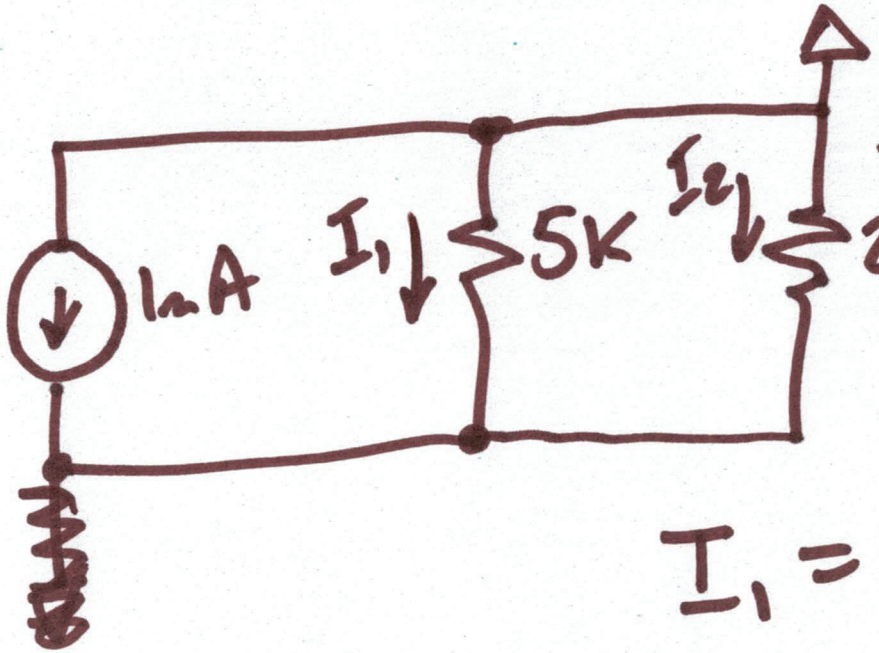

+ V1 −
R1
I
VIN
+
−
R2
+ V1 = I · R1
V2 = VIN · R1 / (R1 + R2)
VIN − R1 I − R2 I = 0
I = VIN / (R1 + R2)
V2 = VIN · R2 / (R1 + R2)



$$I \cdot 1K + 2 + I \cdot 3k + (-1) + 2kI = 0$$

$$I \cdot 6K = -1$$

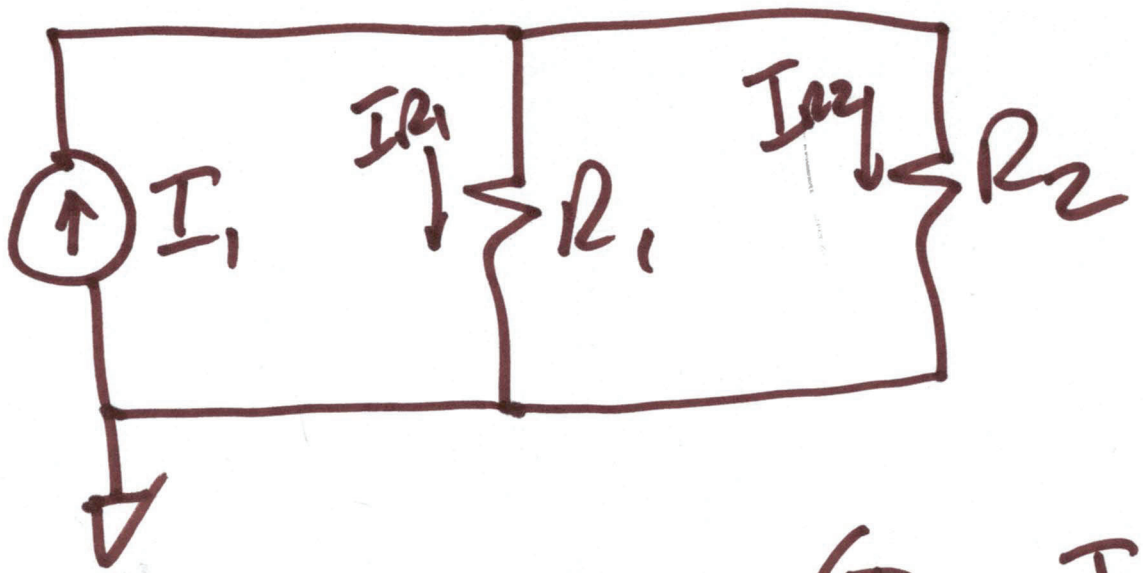
$$I = \frac{-1}{6}\ mA$$



$I_2 \cdot 2k = I_1 \cdot 5k$

$$I_1 = -1mA \cdot \frac{2k}{5k+2k}$$

$$I_2 = -1mA \cdot \frac{5k}{5k+2k}$$



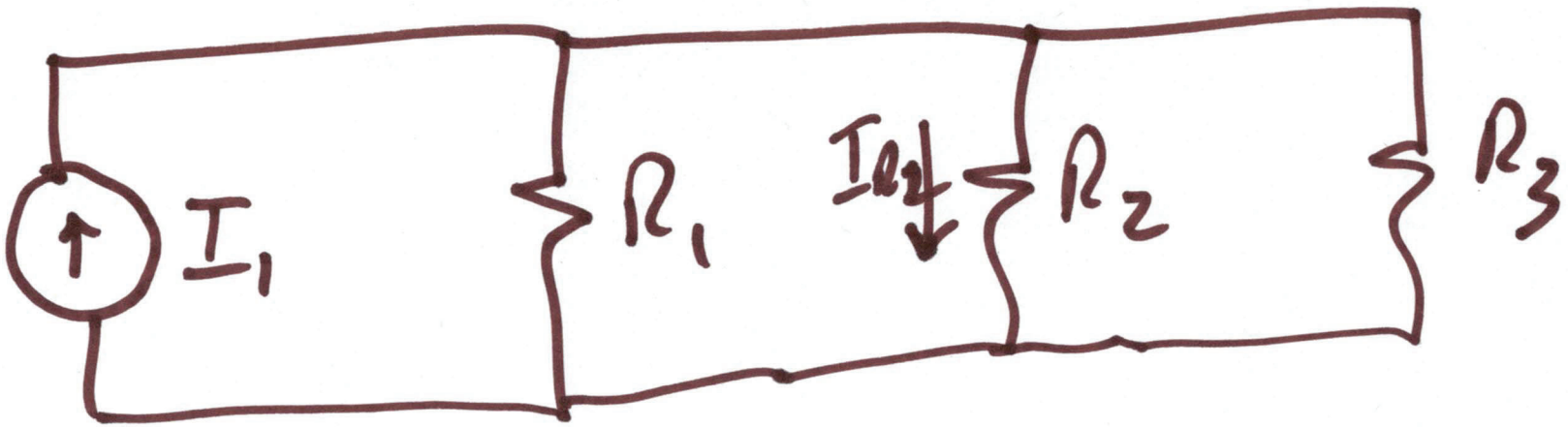
$$I_1 = I_{R_1} + I_{R_2}$$

$$I_{R_1} \cdot R_1 = I_{R_2} R_2$$

$$I_{R_1} \cdot R_1 = (I_1 - I_{R_1}) R_2$$

$$I_{R_1}(R_1 + R_2) = I_1 \cdot R_2$$

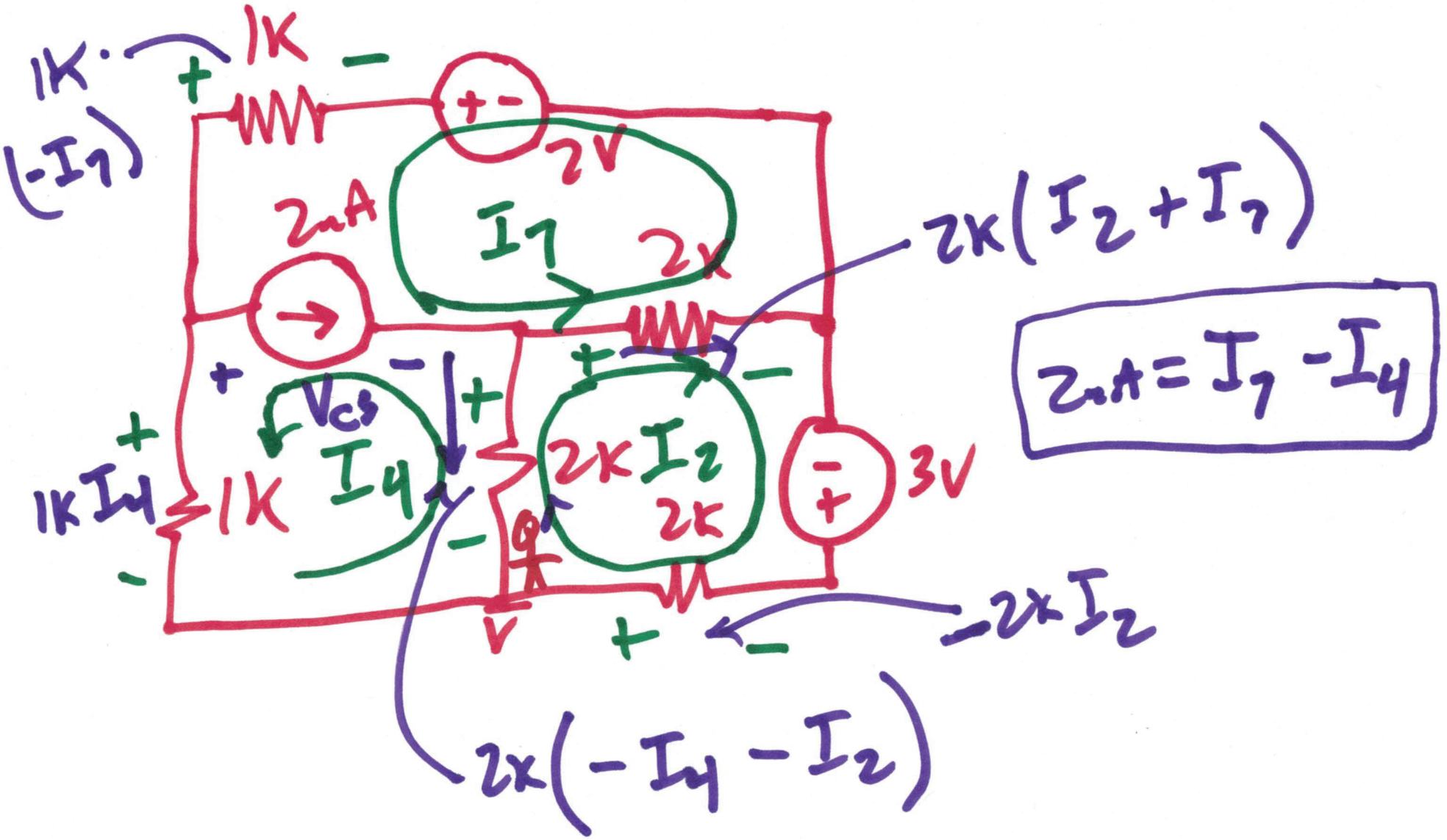
$$\boxed{I_{R_1} = I_1 \cdot \frac{R_2}{R_1 + R_2}}$$



$$I_{R2} = I_1 \cdot \frac{R_1 \| R_3}{R_1 \| R_3 + R_2}$$

$$= I_1 \cdot \frac{\frac{R_1 \cdot R_3}{R_1 + R_3}}{\frac{R_1 R_2}{R_1 + R_3} + R_2}$$

8)


1K
1K
(-I7)
2V
2mA
I7
2K
2K(I2+I7)
2mA = I7 - I4
Vcs
I4
1K I4
1K
2K I2
2K
3V
V
-2K I2
2K(-I4-I2)

٦)

$$0 = -(-2K I_2) - 3 + 2 + (1K(-I_7)) - 1K I_4$$

$$2mA = I_7 - I_4$$

$$-2K(I_4 + I_2) - 2K(I_2 + I_7) + 3 - 2K I_2 =$$

$$0 = I_7(-1K) + I_4(-1K) + I_2 \cdot (2K) - 1$$

$$0 = I_7 + I_4 - 2I_2 + 1mA$$

$$0 = I_7(-2K) + I_4(-2K) + I_2(-6K) + 3 = 0$$

$$0 = I_7 + I_4 + 3I_2 - 1.5mA = 0$$

$$I_7 = 2mA + I_4$$

10)

$$2mA + I_4 + I_4 - 2I_2 + 1mA = 0$$

$$2mA + I_4 + I_4 + 3I_2 - 1.5mA = 0$$

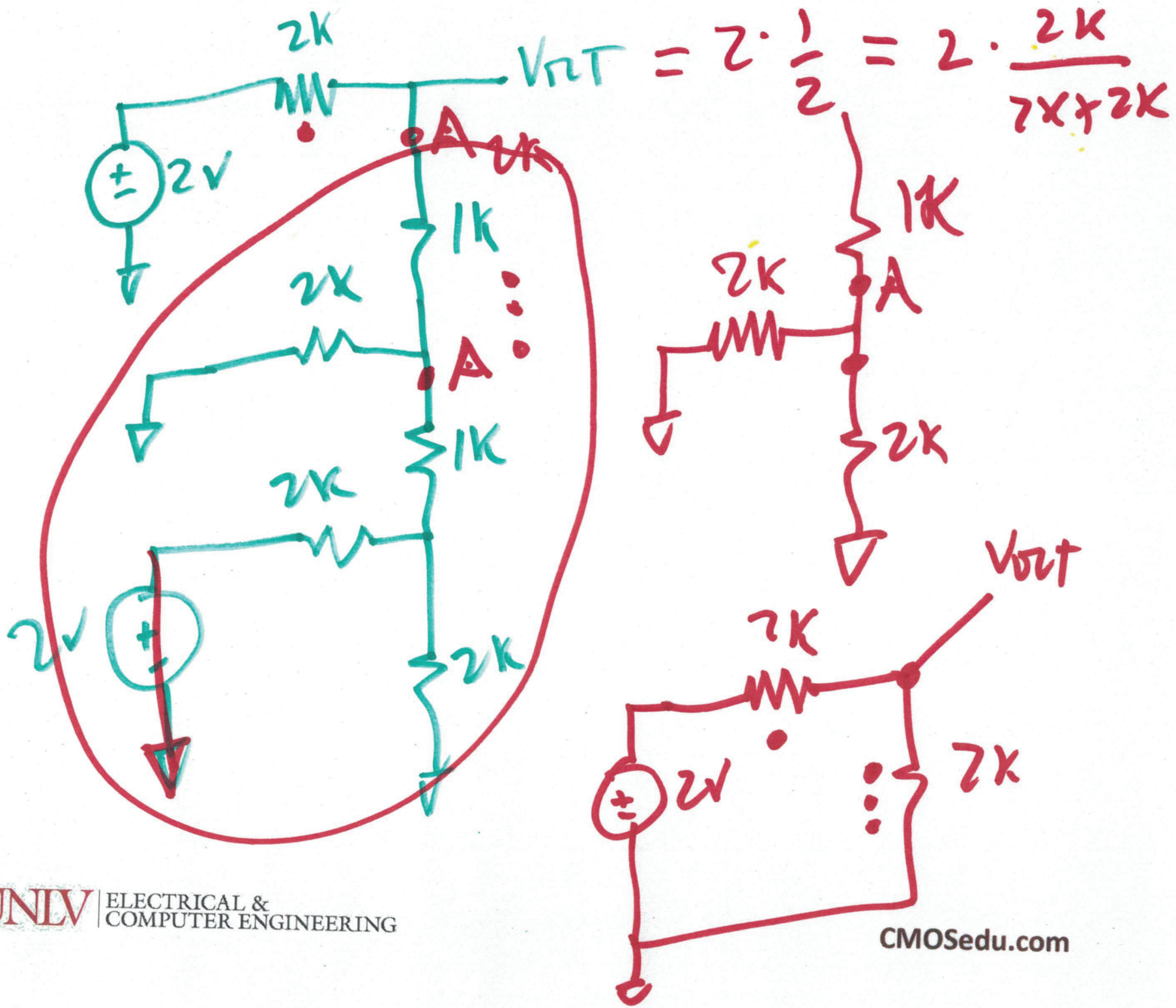
$$2I_4 + 3I_2 + \frac{1}{2}mA = 0$$

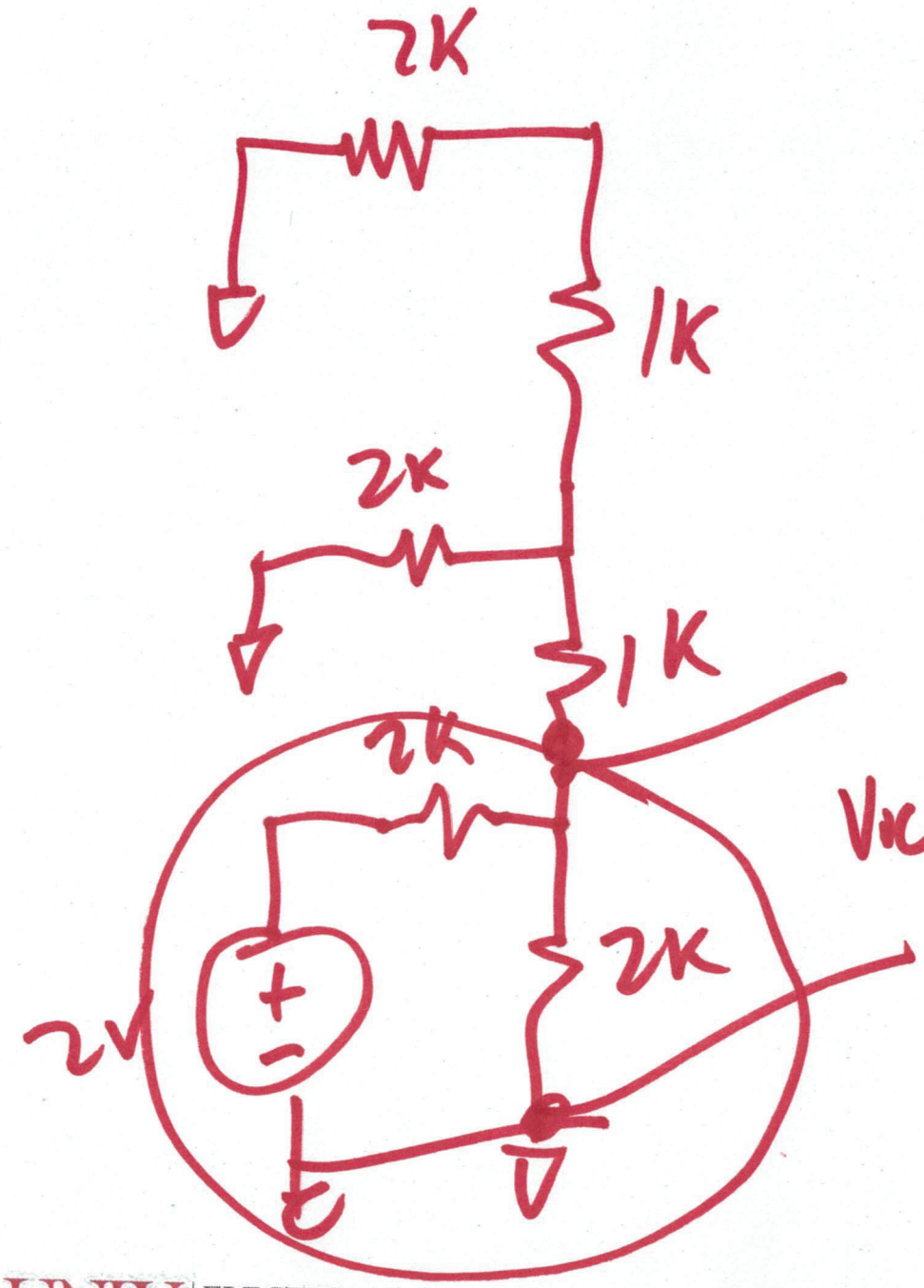
$$I_2 = -\frac{1}{6}mA - \frac{2}{3}I_4$$

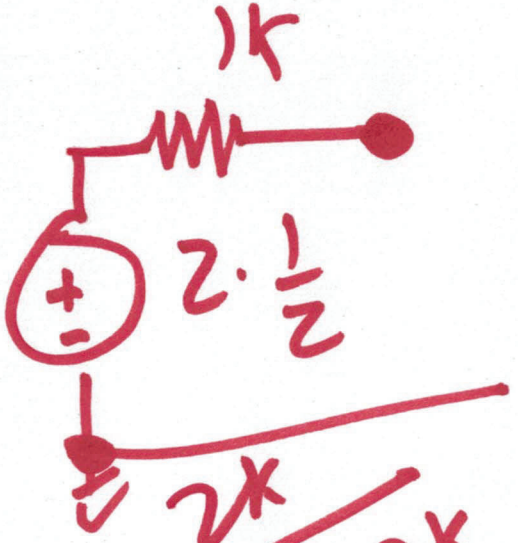
$$2mA + 2I_4 + \frac{1}{3}mA + \frac{4}{3}I_4 + 1mA = 0$$

$$\frac{10}{3}I_4 = \frac{-10}{3}mA$$

$$I_4 = -1mA$$


2K
2V
A
1K
2K
A
1K
2K
2V
2K
$V_{OUT} = 2 \cdot \frac{1}{2} = 2 \cdot \frac{2K}{2K+2K}$
1K
2K
A
2K
V_{OUT}
2K
2V
2K
UNLV
ELECTRICAL & COMPUTER ENGINEERING
CMOSedu.com

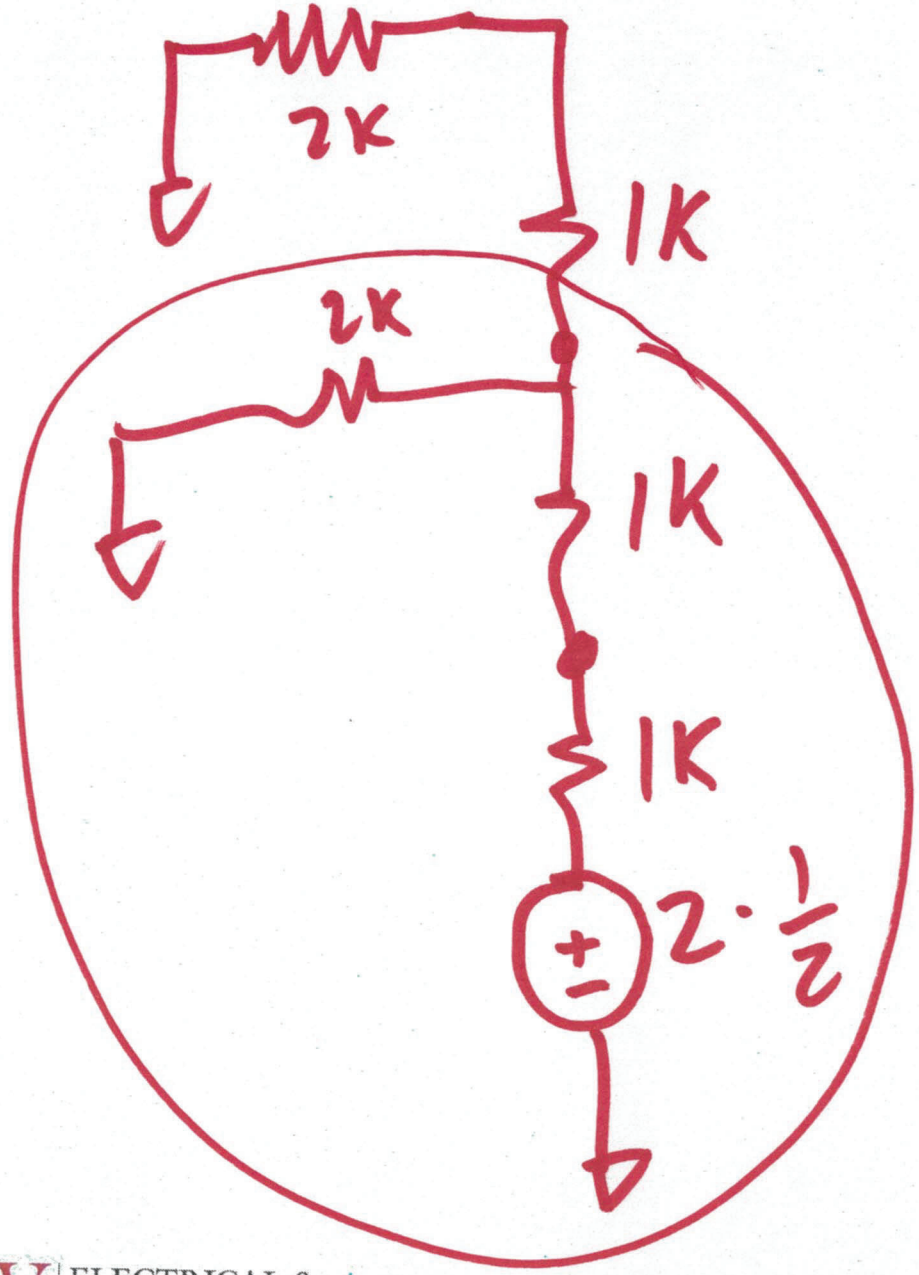


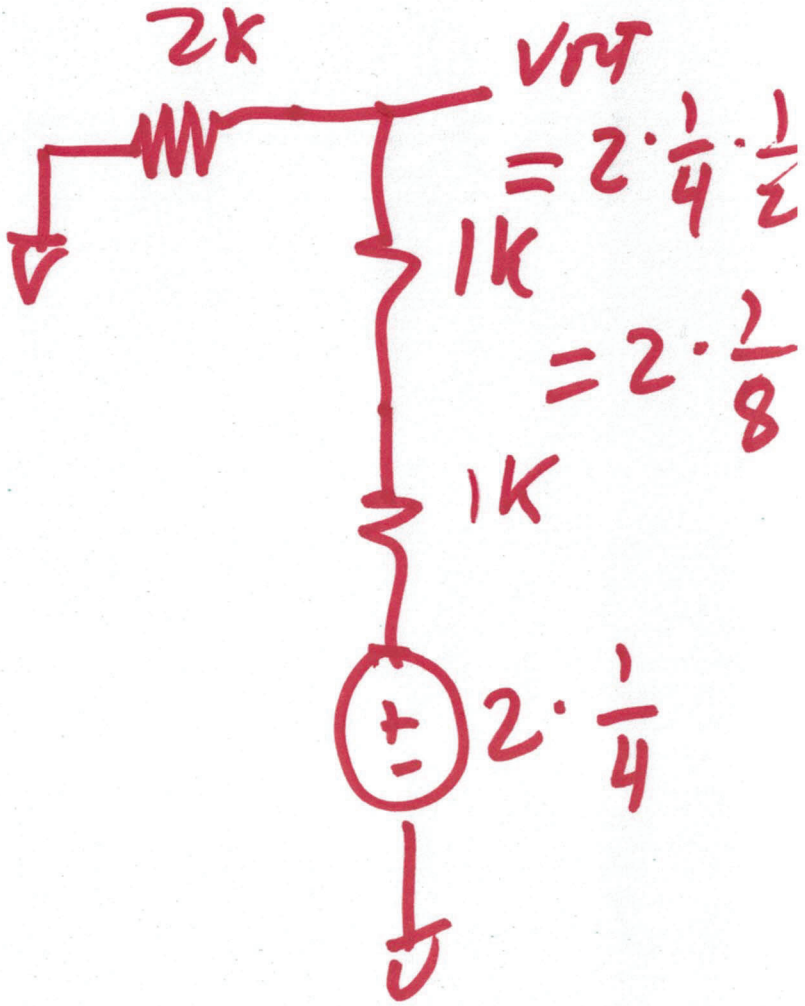


$$V_{TH} = 2 \cdot \frac{2K}{2K+2K}$$

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

$$R_{TH} = 1K$$


2K
1K
2K
1K
1K
2·1/2


2K
VOUT
= 2·1/4·1/2
1K
= 2·2/8
1K
2·1/4