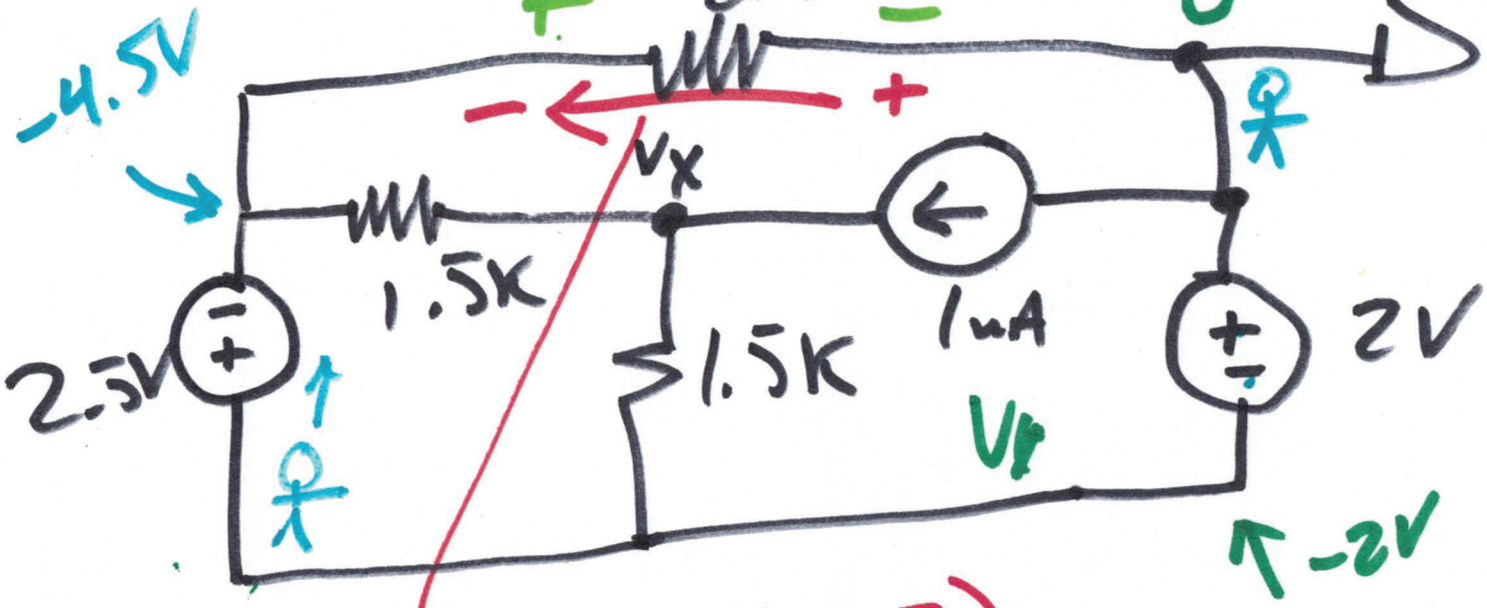
EE 220 circuits 1

Sept. 23, 2020

Lecture 9,

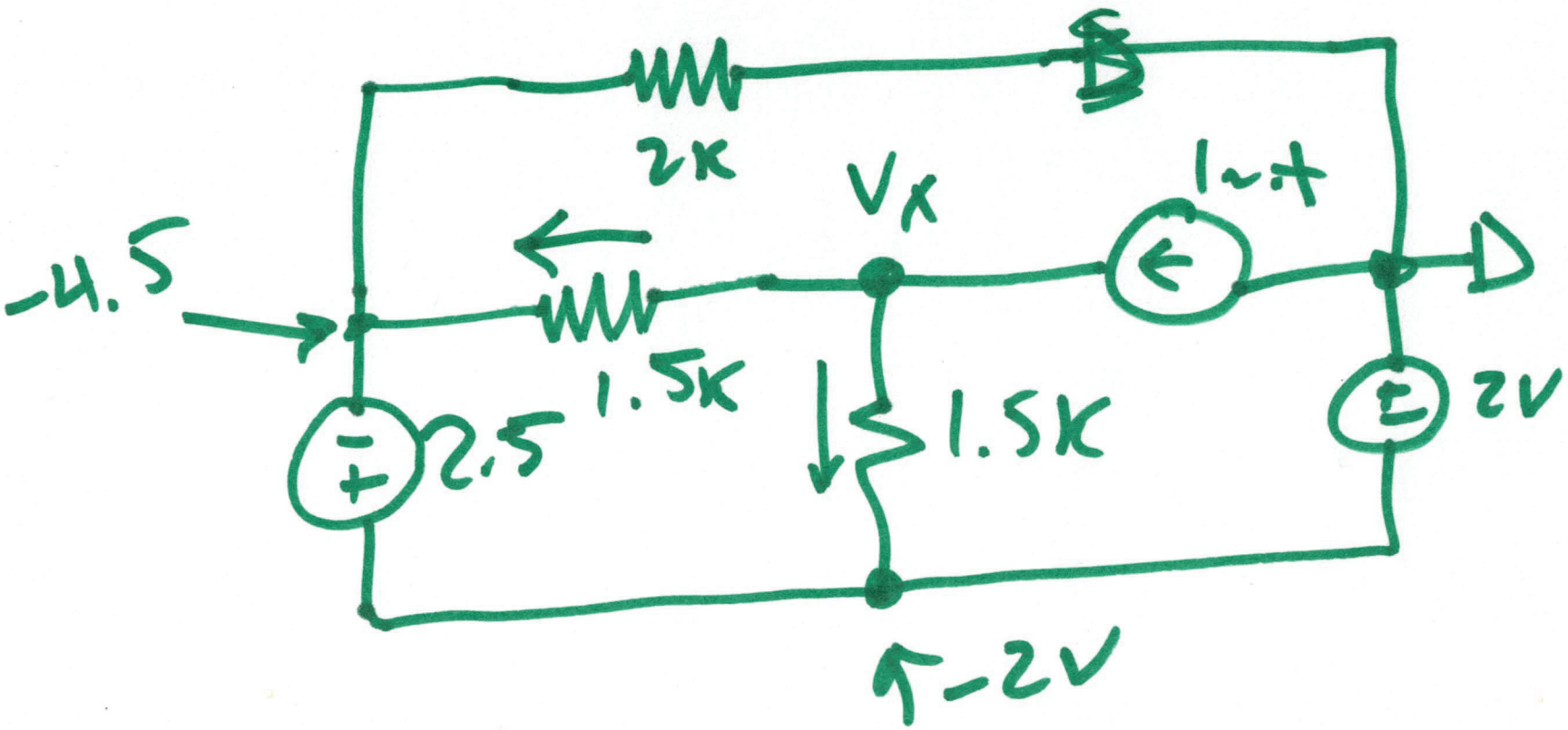
$V = IR$



$$\frac{0-(-4.5)}{2K} = +2.25mA$$

$$= -2.25mA$$

$$\frac{-4.5-0}{2K}$$



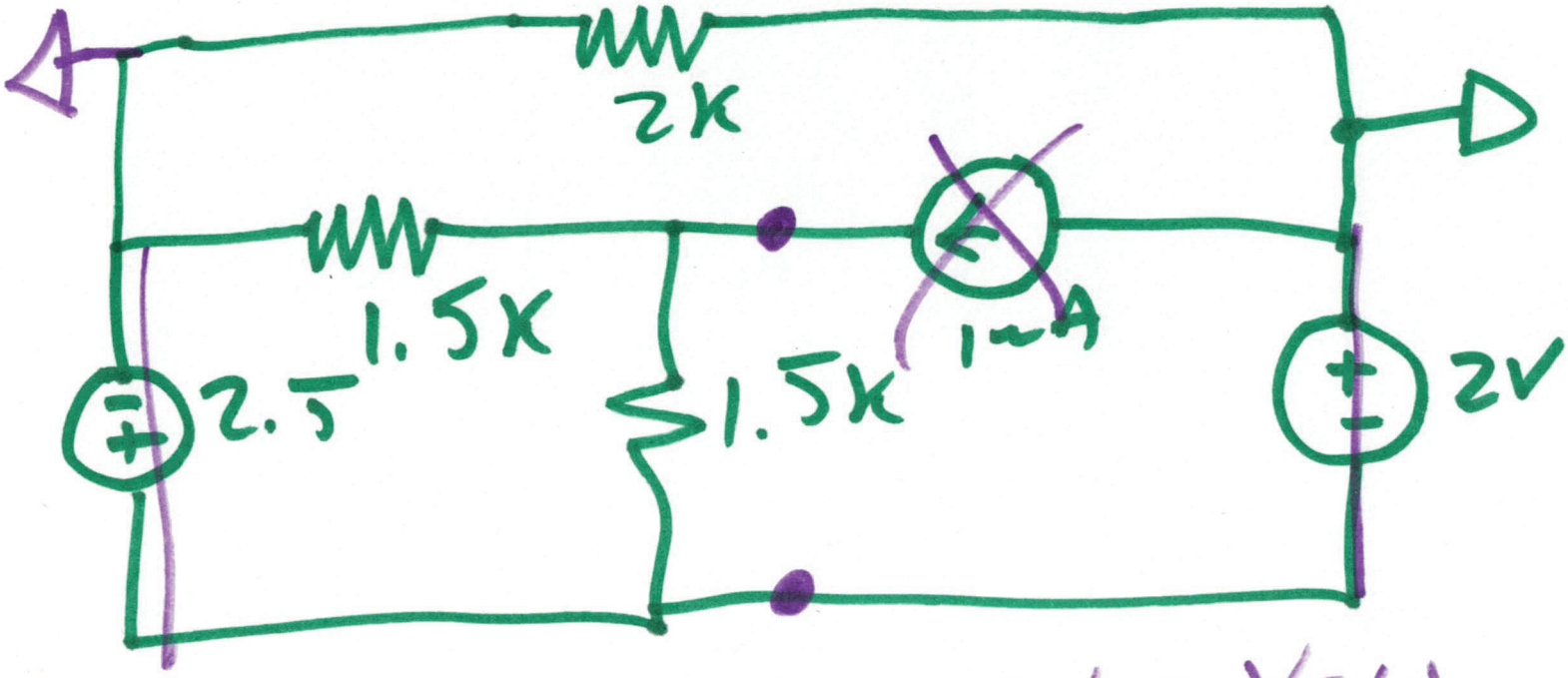
$$\frac{V_x-(-4.5)}{1.5k}+\frac{V_x-(-2)}{1.5k}=1\sim4$$

$$V_x+4.5+V_x+2=1.5$$

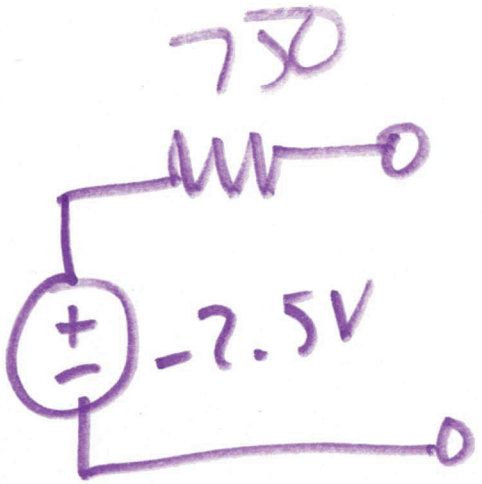
$$2V_x+6.5=1.5$$

$$2V_x=-5V,\quad V_x=-2.5V$$

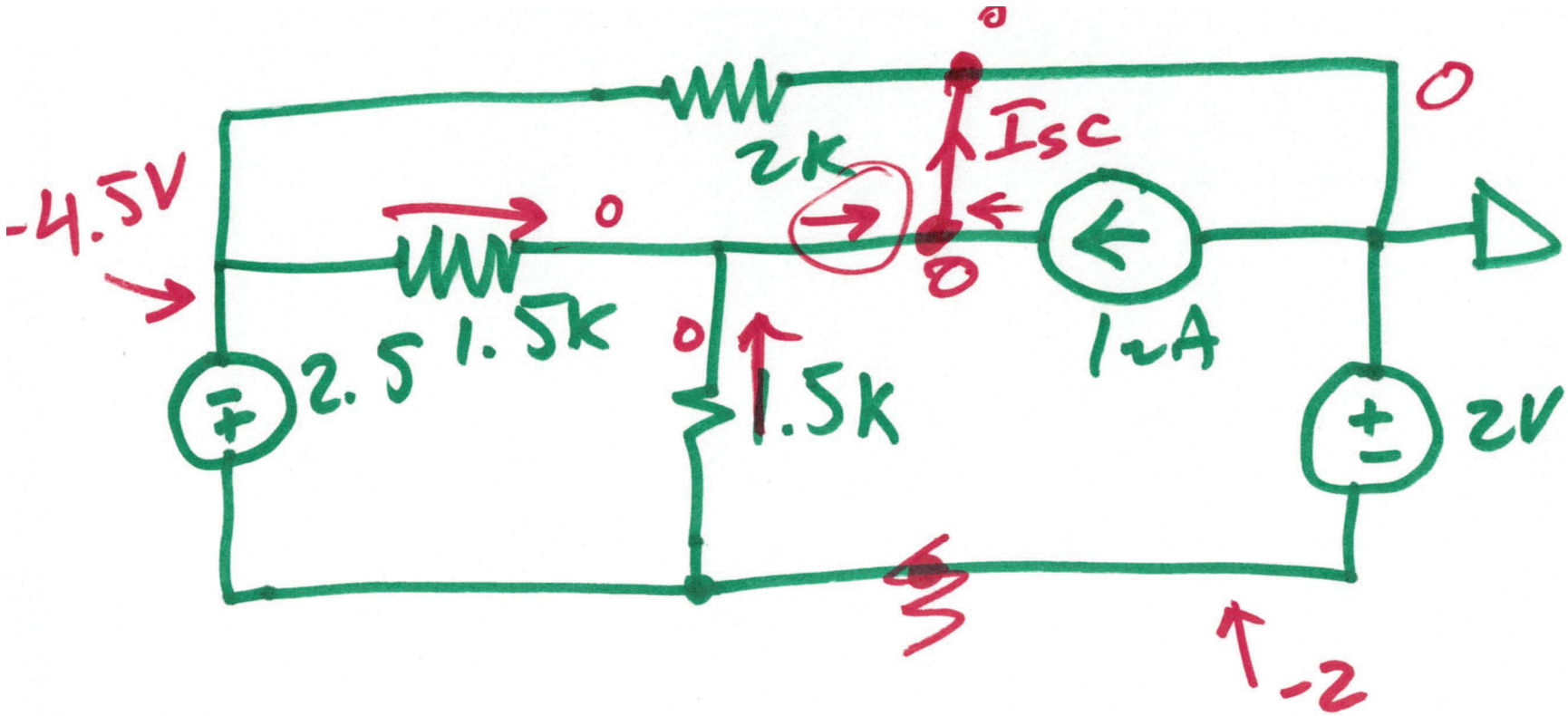
2)



$$V_{OC} = V_X = -2.5V = V_{THN}$$



$$R_{THN} = \underbrace{1.5k \| 1.5k}_{750}$$



$\frac{2}{\frac{3}{2}} = \frac{4}{3}$

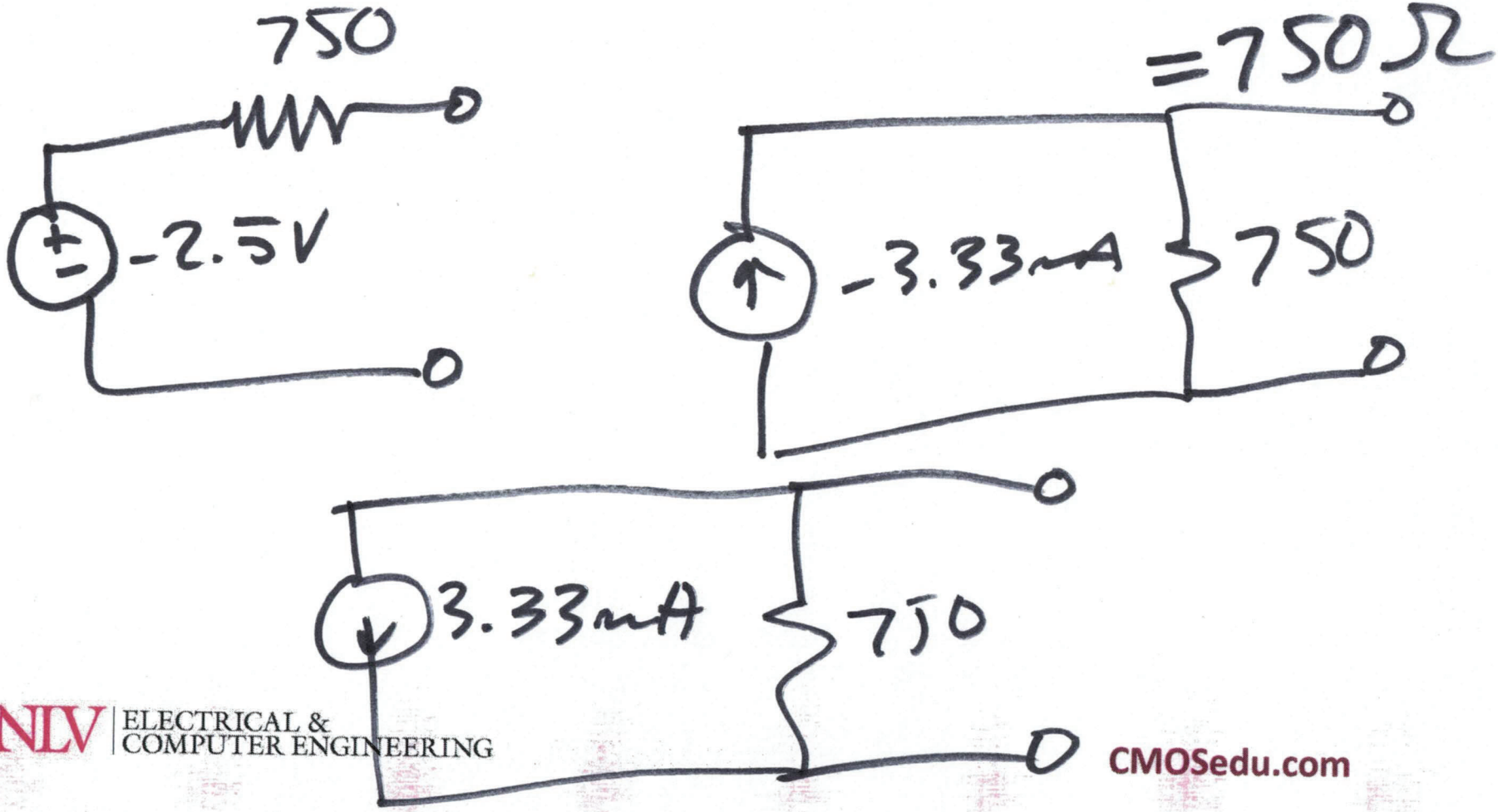
$$\frac{-4.5-0}{1.5k} + \frac{-2-0}{1.5k} + 1mA = I_{sc}$$

$$-3mA + -1.33mA + 1mA = I_{sc}$$

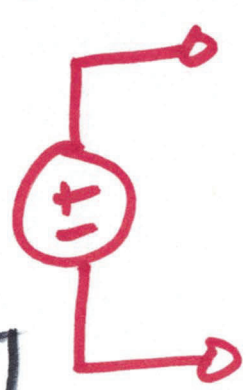
$$\boxed{I_{sc} = -3.33mA}$$

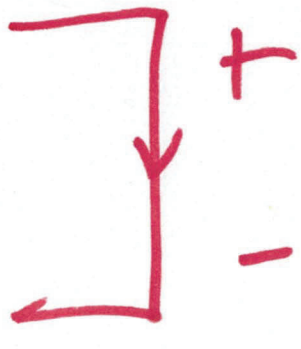
$V_{OC} = -2.5V$ $I_{SC} = -3.33mA$

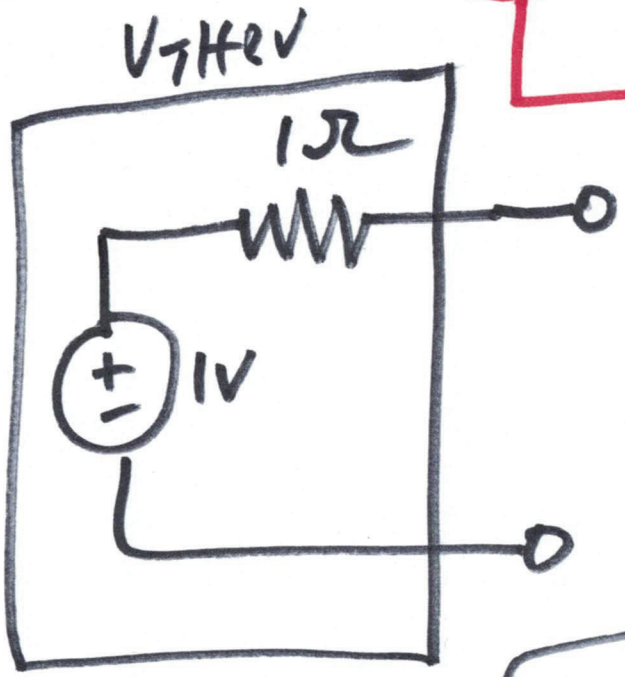
$$R_{TH} = \frac{V_{OC}}{I_{SC}} = \frac{2.5}{3.33mA} = 750\Omega$$



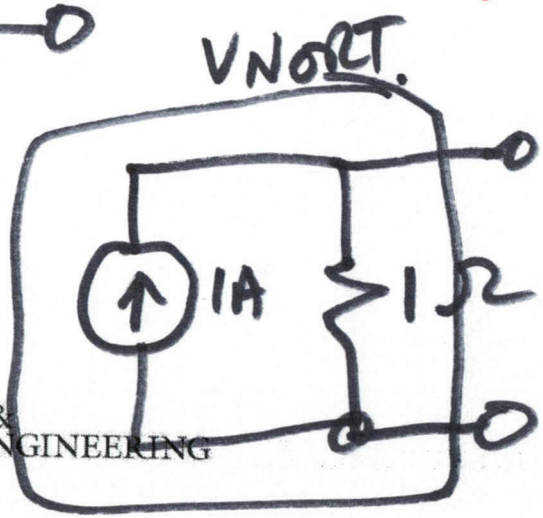
Power = Voltage · current







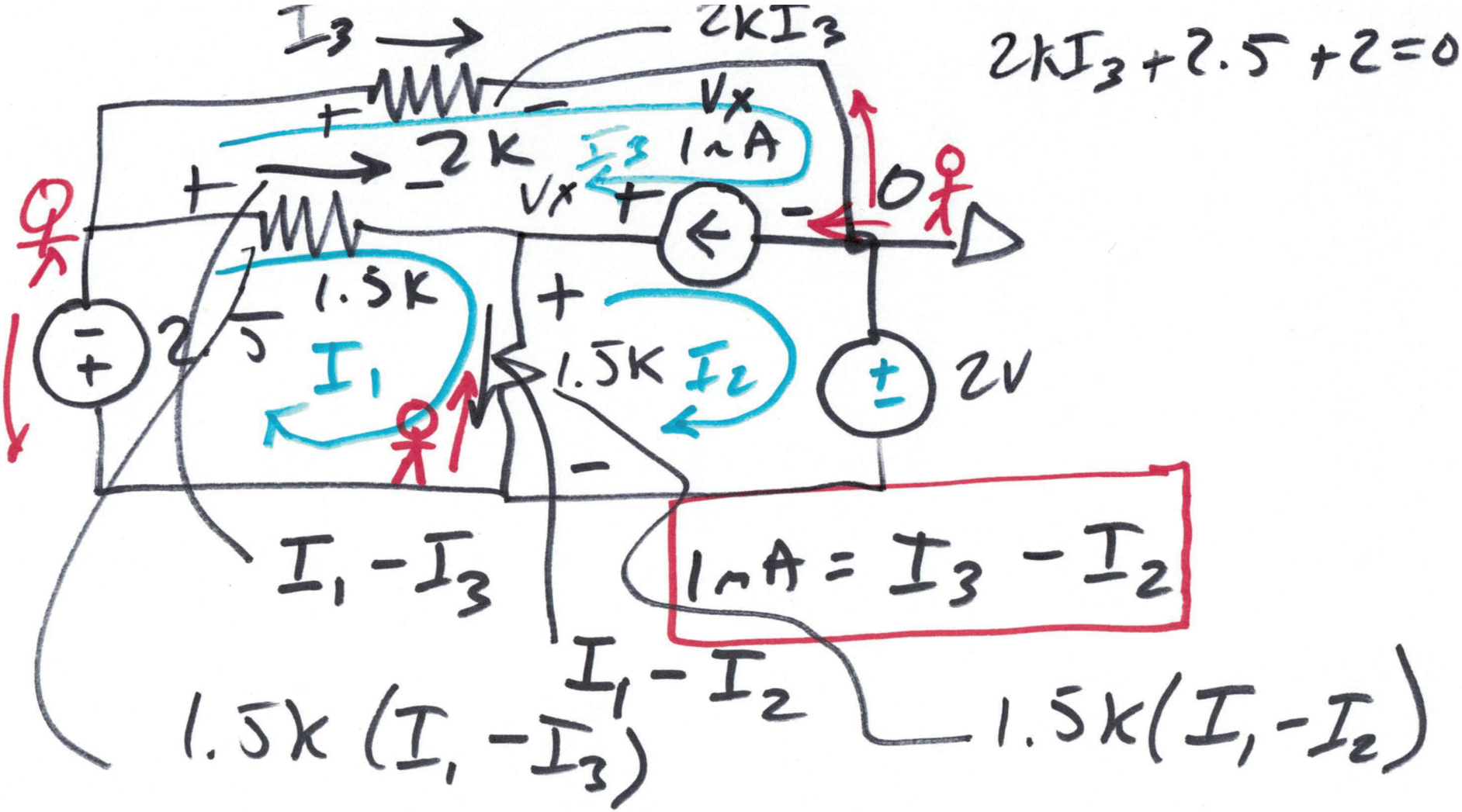
$R = \frac{V}{I} \rightarrow I = \frac{V}{R}$



$P = VI = I^2R$

$= \frac{V^2}{R}$

b)



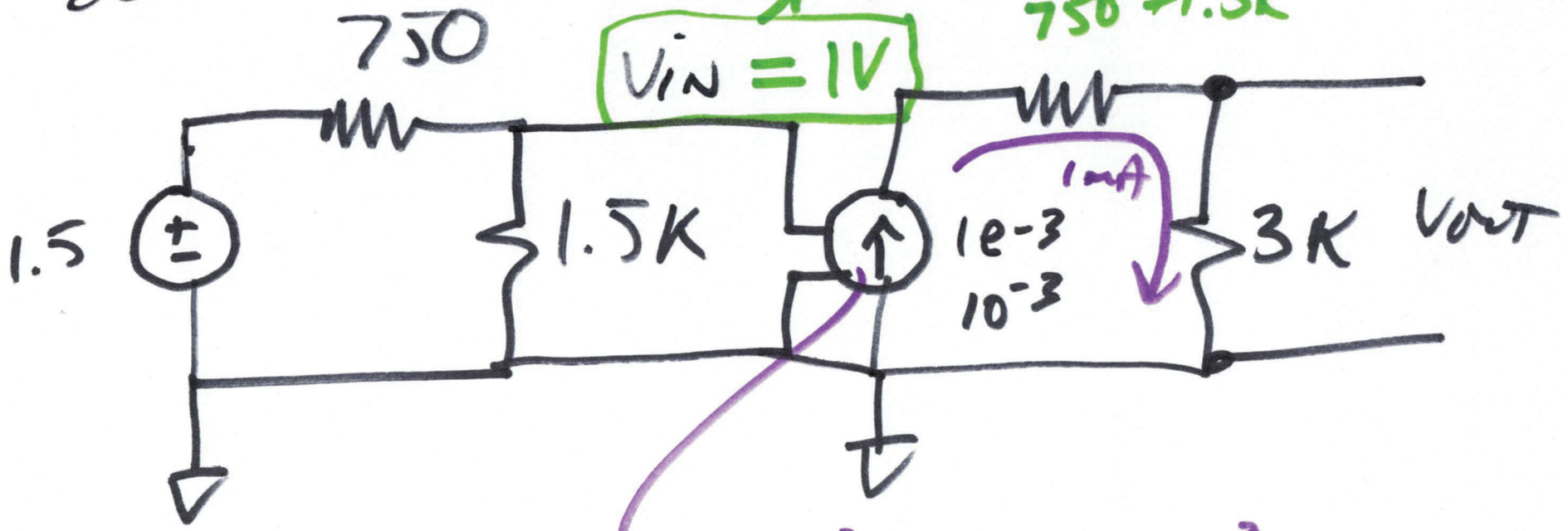
$2kI_3 + 2.5 + 2 = 0$

$2kI_3 - 1.5k(I_1 - I_3) - V_x = 0$

$V_x - 1.5k(I_1 - I_2) + 2 = 0$

7) $1.5k(I_1 - I_2) + 1.5k(I_1 - I_3) + 2.5 = 0$

2b

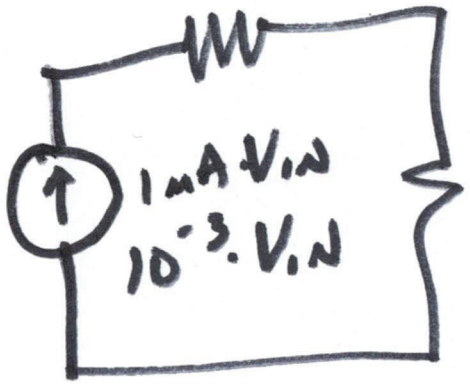


$1.5 \cdot \frac{1.5K}{750 + 1.5K} = 1.5 \cdot \frac{2}{3}$

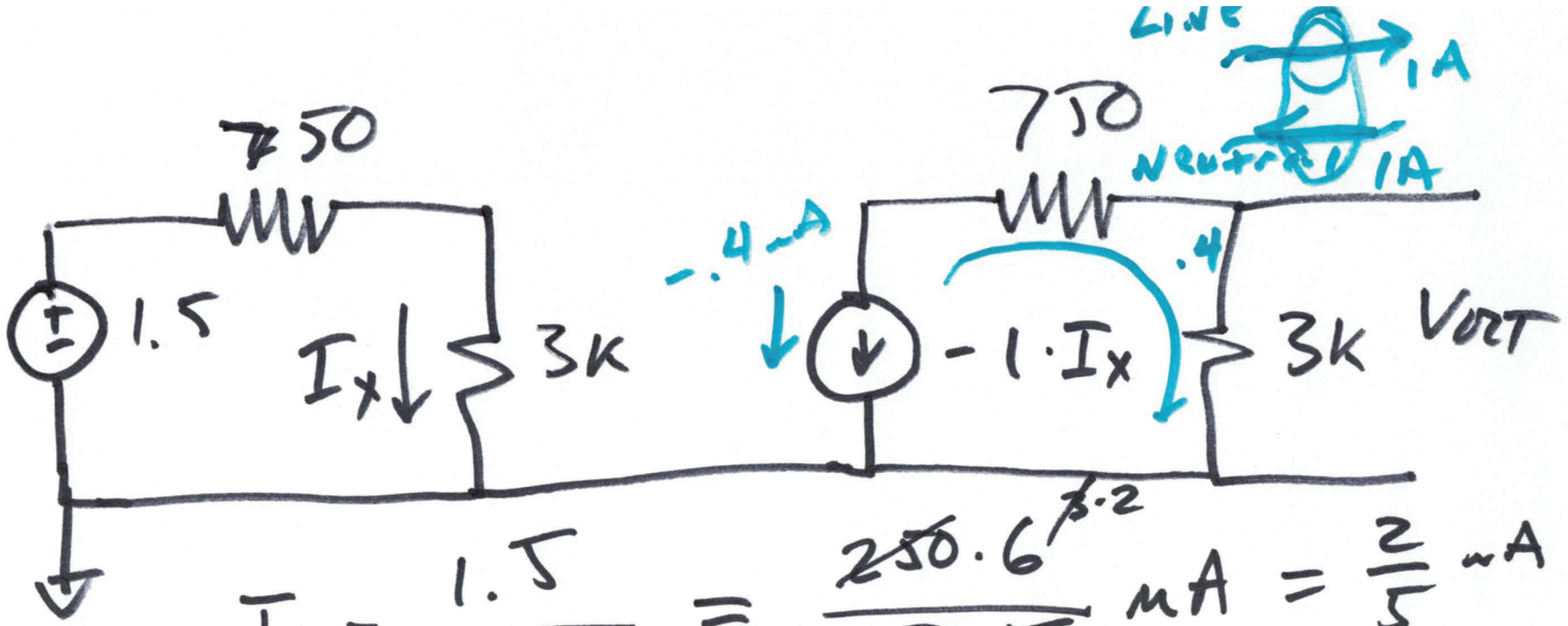
$V_{IN} = 1V$

$10^{-3} \cdot V_{IN} = 10^{-3} \cdot 1 = 1mA$

$V_{OUT} = 1mA \cdot 3k = 3V$



2d



$$I_x = \frac{1.5}{3.75k} = \frac{250 \cdot 6}{250 \cdot 15} \text{ mA} = \frac{2}{5} \text{ mA}$$

$$I_x = 0.4 \text{ mA}$$

$$\frac{250 \cdot 4}{1000} + \frac{250 \cdot 2}{500} = 1.5k$$

$$V_{OUT} = 3k \cdot \frac{2}{5} \text{ mA} = \frac{6}{5} V = 1.2V$$

9)