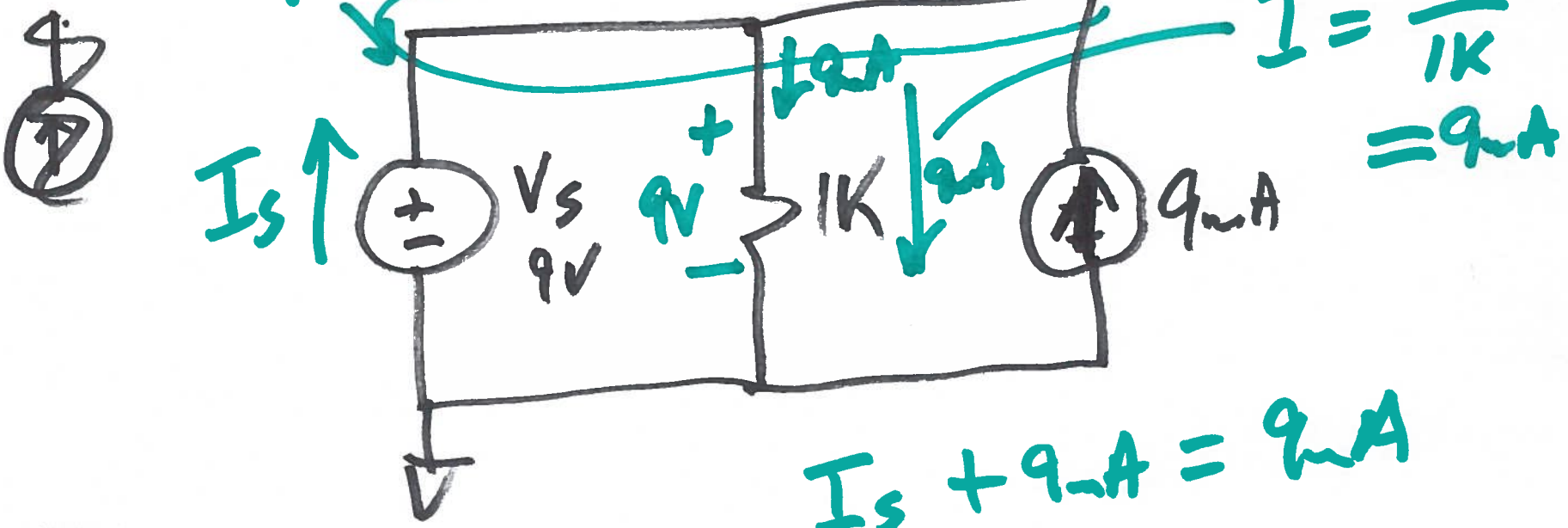
Lecture 4

EE 220

Circuits I

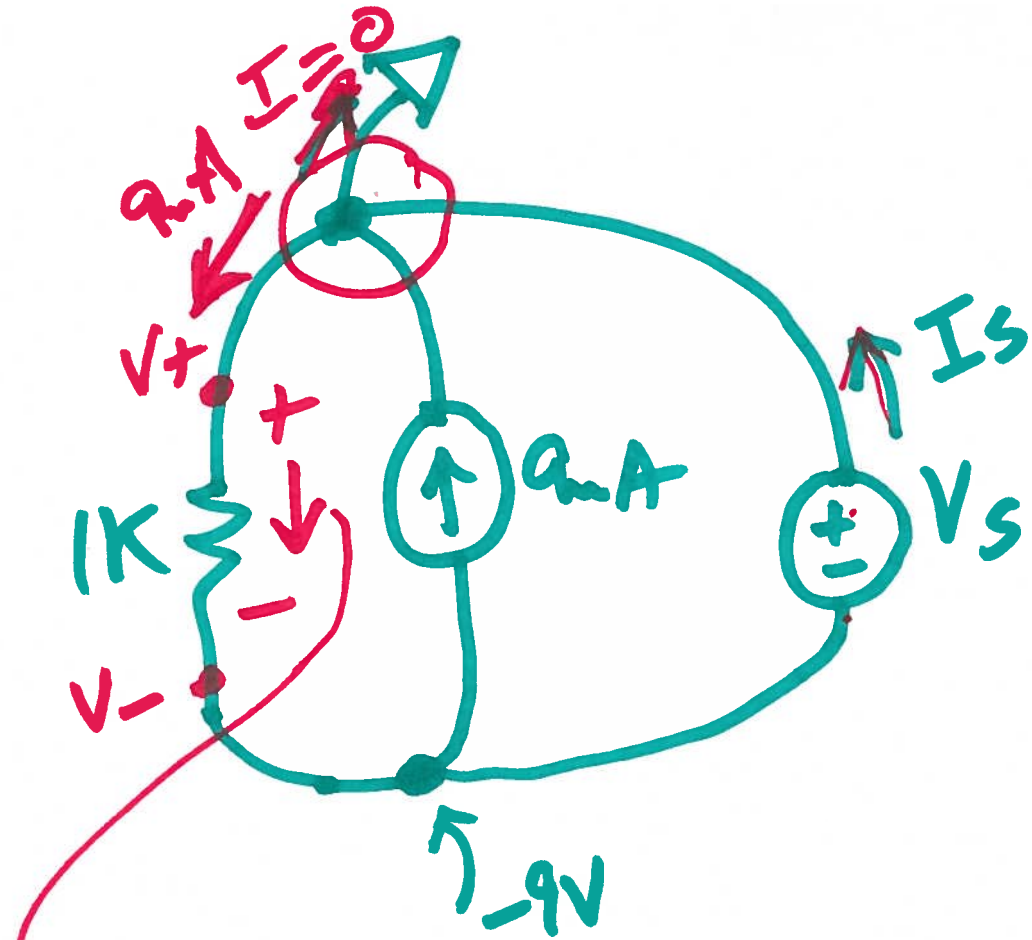
$I = \frac{V}{R}$

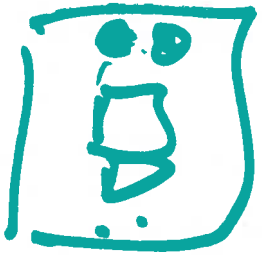


$I = \frac{9V}{1K} = 9mA$

$I_s + 9mA = 9mA$

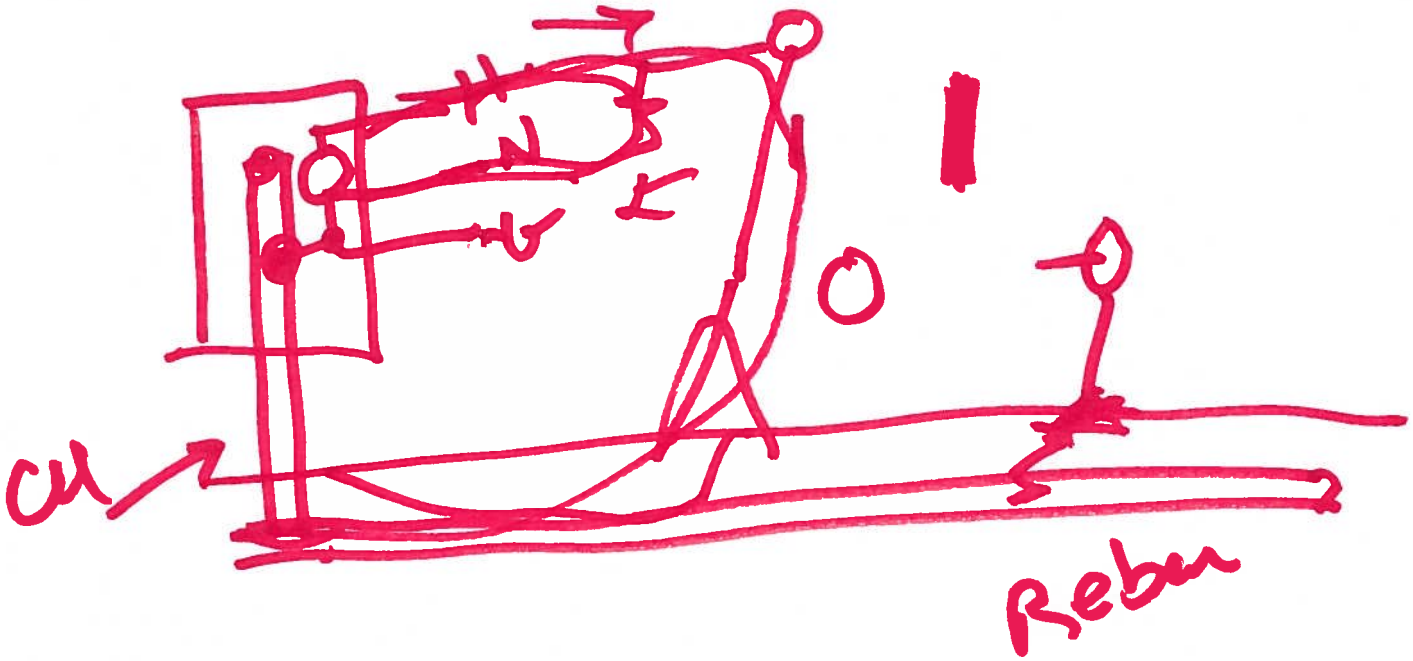
$I_s = 0$

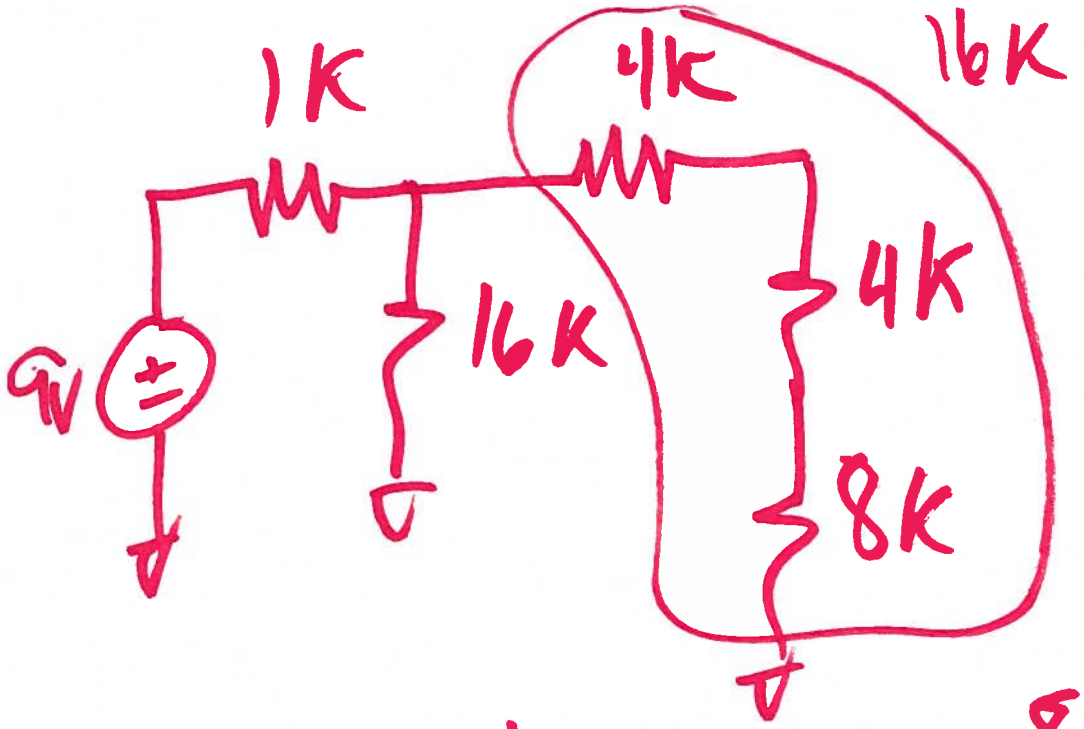


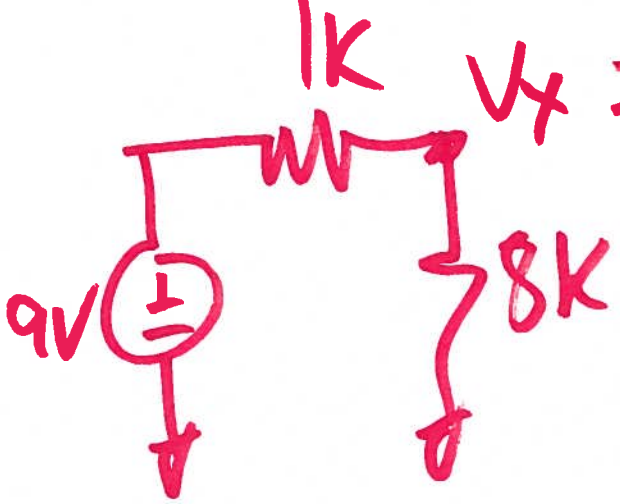


$$I = \frac{V_+ - V_-}{1K} = \frac{0-(-9)}{1K} = g_m A$$

$$0 + g_m A = g_m A + I_s$$


Reb





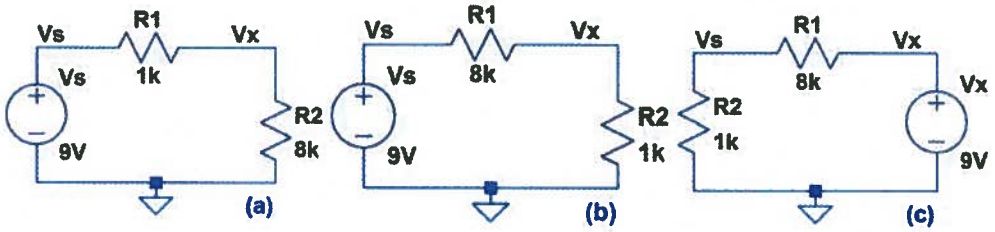
$$V_x = \frac{8K}{1K+8K} \cdot 9V =$$

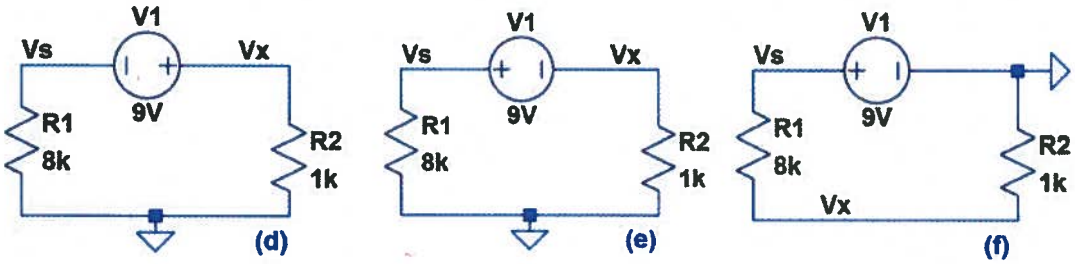
$$\underline{\underline{8V}}$$

H.W. #3 EE 220 Fall 2016

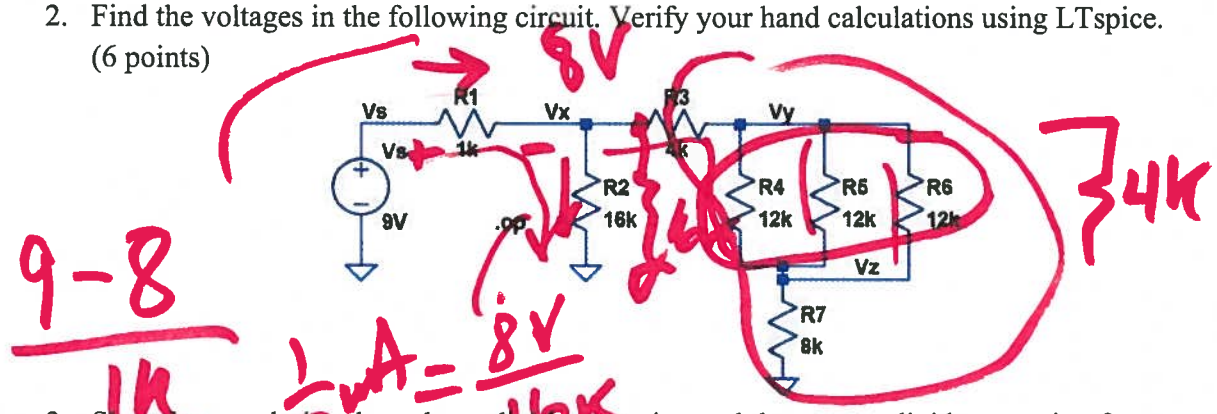
Show your work for credit!

1. Find the voltages Vx and Vs in each of the following circuits. Verify your hand calculations using LTspice. (6 points)

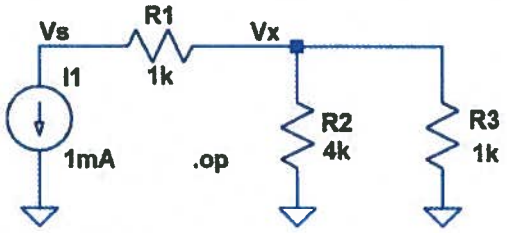


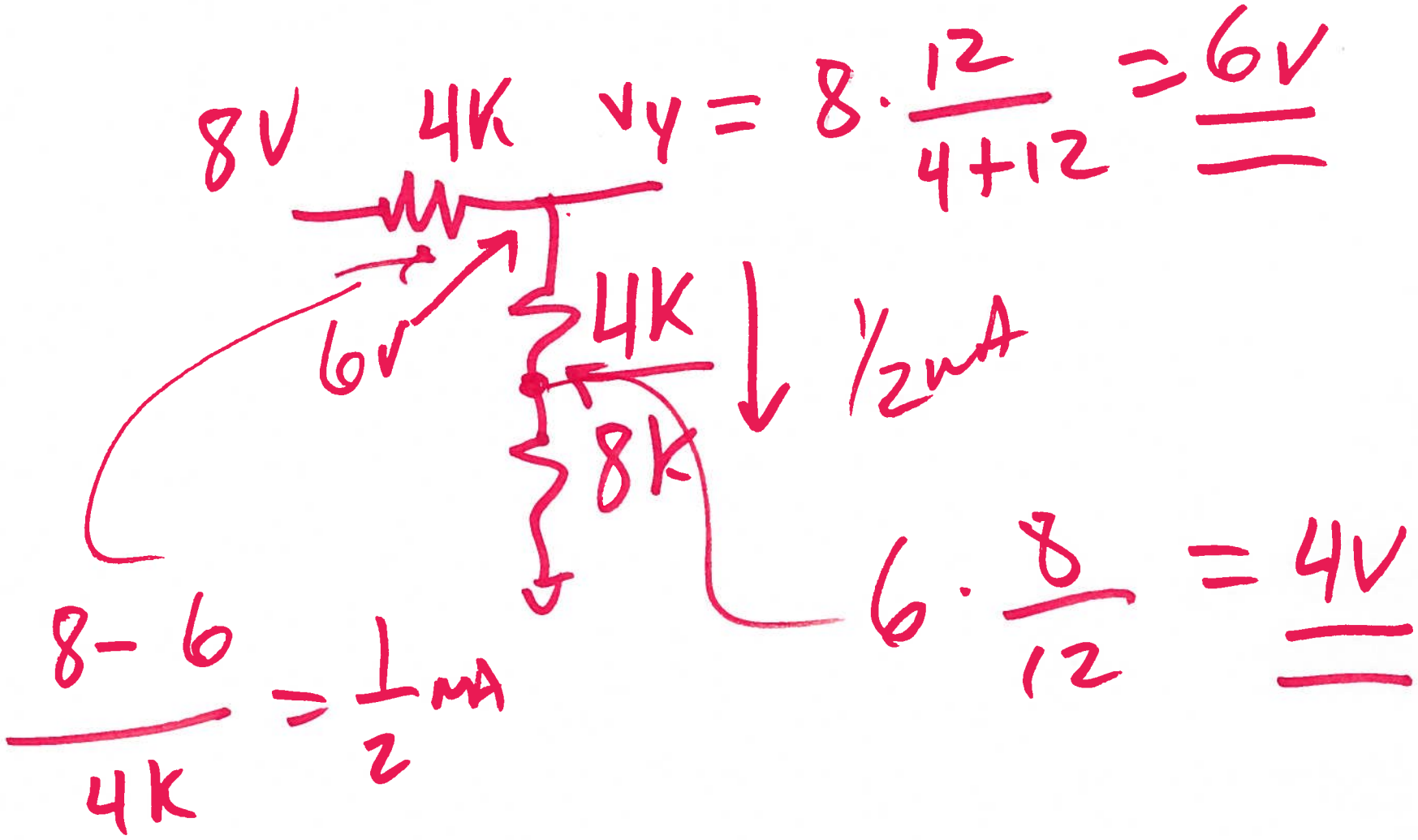


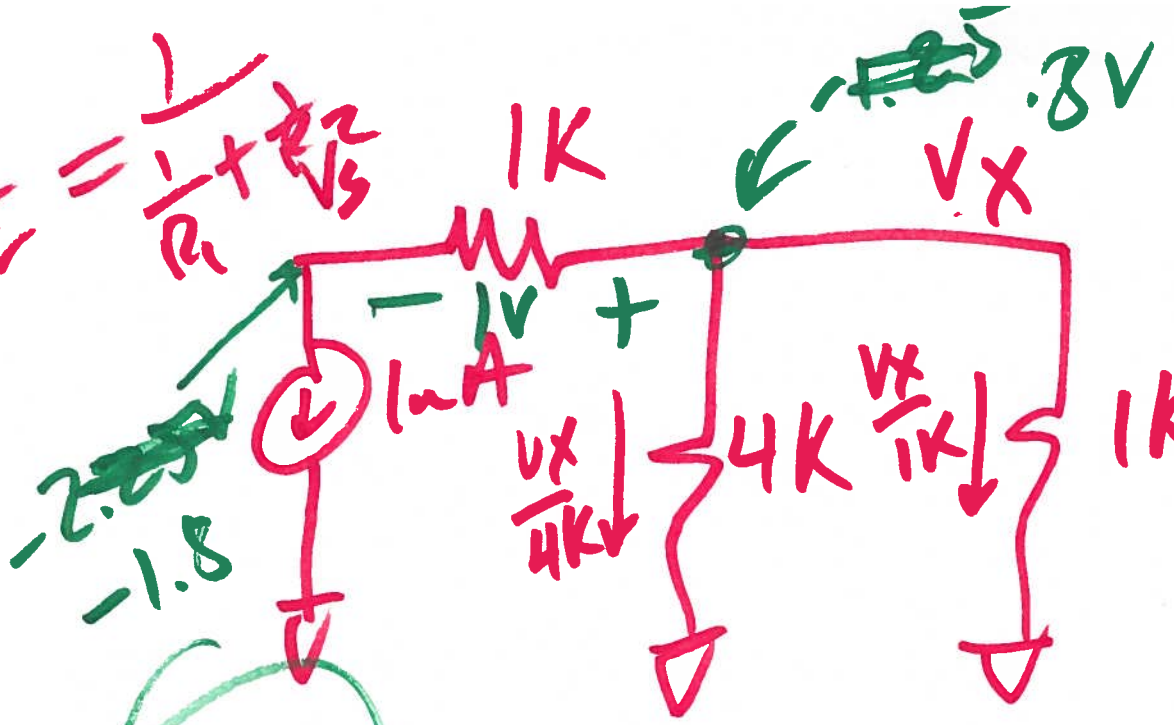
2. Find the voltages in the following circuit. Verify your hand calculations using LTspice. (6 points)



3. Show how to derive the voltage divider equation and the current divider equation for a two resistor circuit. Ensure your derivation includes the two schematics you are using. Provide an example for each derivation. (4 points)
4. Calculate Vs, Vx, and the current that flows in R2 and R3. Verify your hand calculations using LTspice. (4 points)




8V
4K
$V_y = 8 \cdot \frac{12}{4+12} = 6V$
6V
4K
8K
½mA
$\frac{8-6}{4K} = \frac{1}{2}mA$
$6 \cdot \frac{8}{12} = 4V$



$$\frac{1}{R_E} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$1K \,||\, 4K$$

$$.8K = \frac{1K \cdot 4K}{1K + 4K}$$

$$\frac{1}{\frac{1}{1K+4K}} = 1K \,||\, 4K$$

$$1mA + \frac{V_x}{4K} + \frac{V_x}{1K} = 0$$

$$-1mA = V_x\left(\frac{1}{4K} + \frac{1}{1K}\right)$$

$$V_x = (0.8K)(-1mA) = -.8V$$

$$V_x = \frac{-1mA}{\frac{1}{4K} + \frac{1}{1K}} = 1K \cdot 4K \cdot (-1mA) \cdot \left(\frac{1}{4K} + \frac{1}{1K}\right)$$

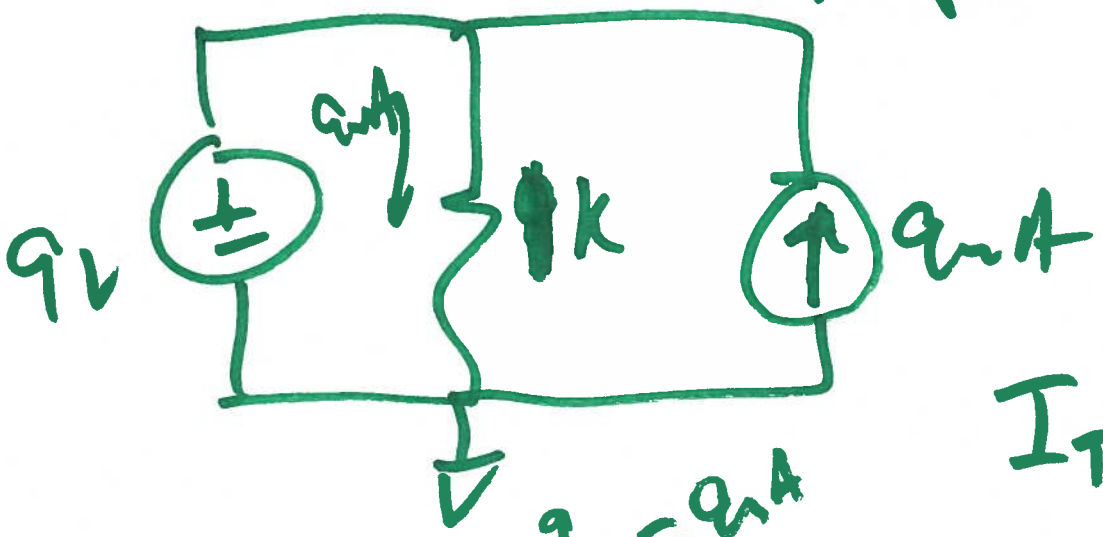
$$-\frac{1}{8} = -\frac{10}{8} = -1\frac{2}{8} = -1\frac{1}{4}$$

$$\frac{1K \cdot 4K}{1K + 4K}$$

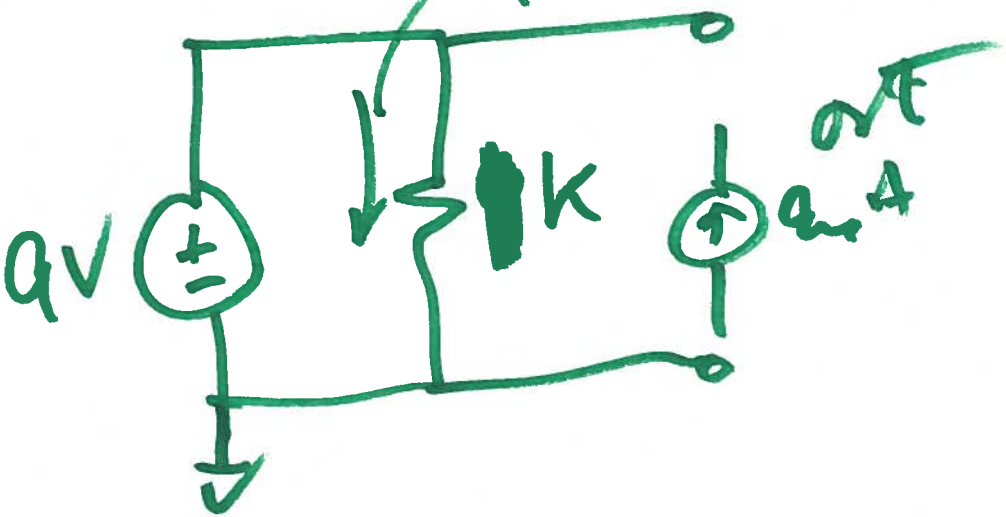
$$.4K \cdot 1$$

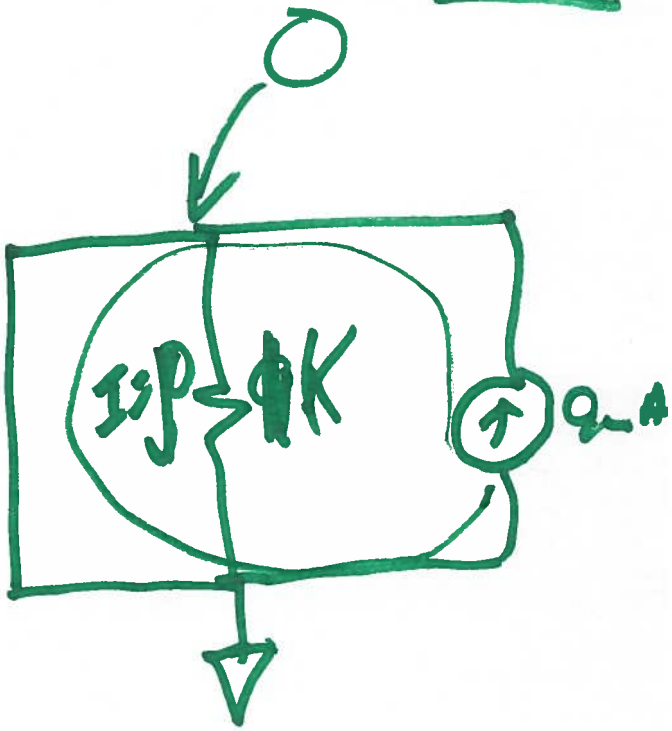
7)

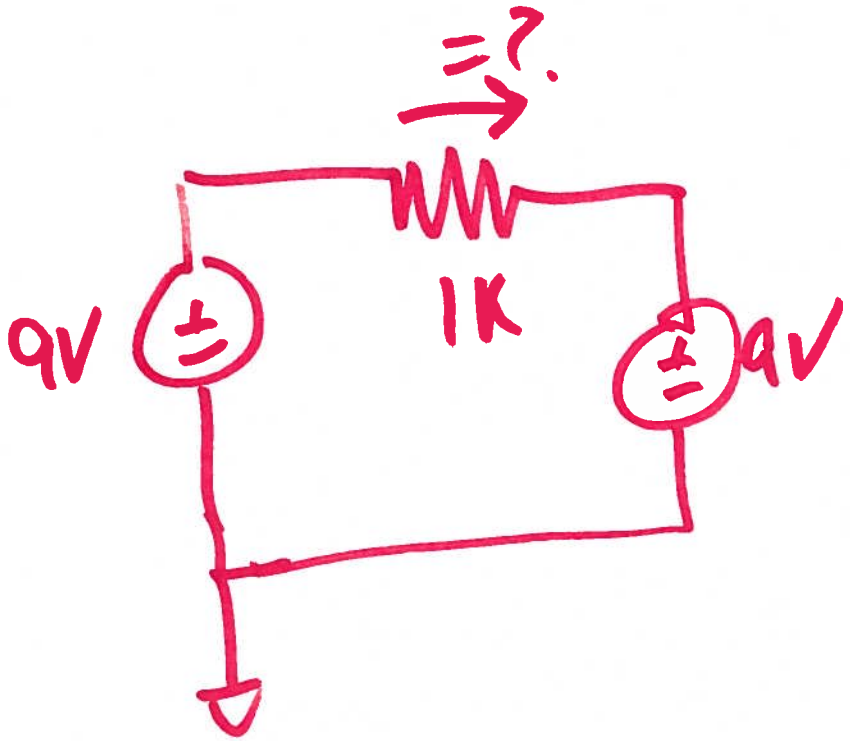
Superposition



$I_T = 9mA + 0 = \underline{9mA}$

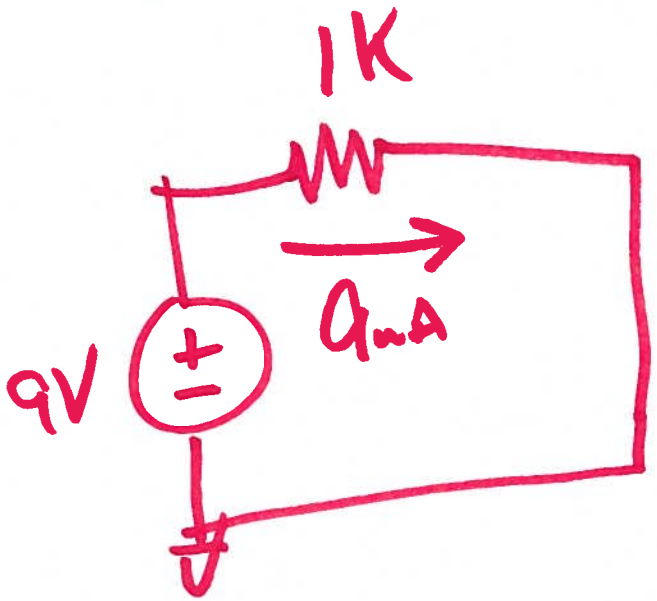


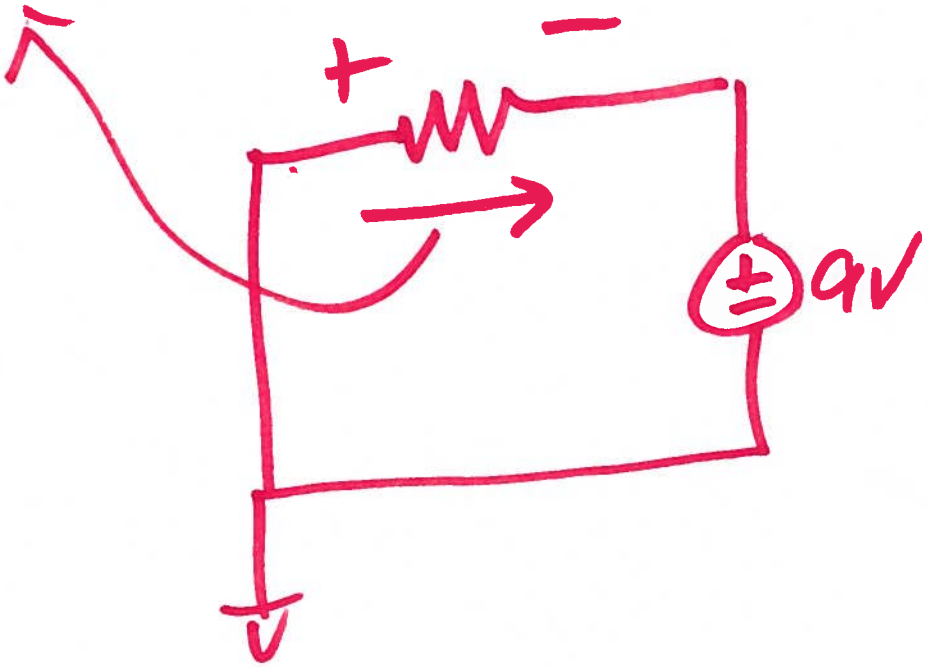


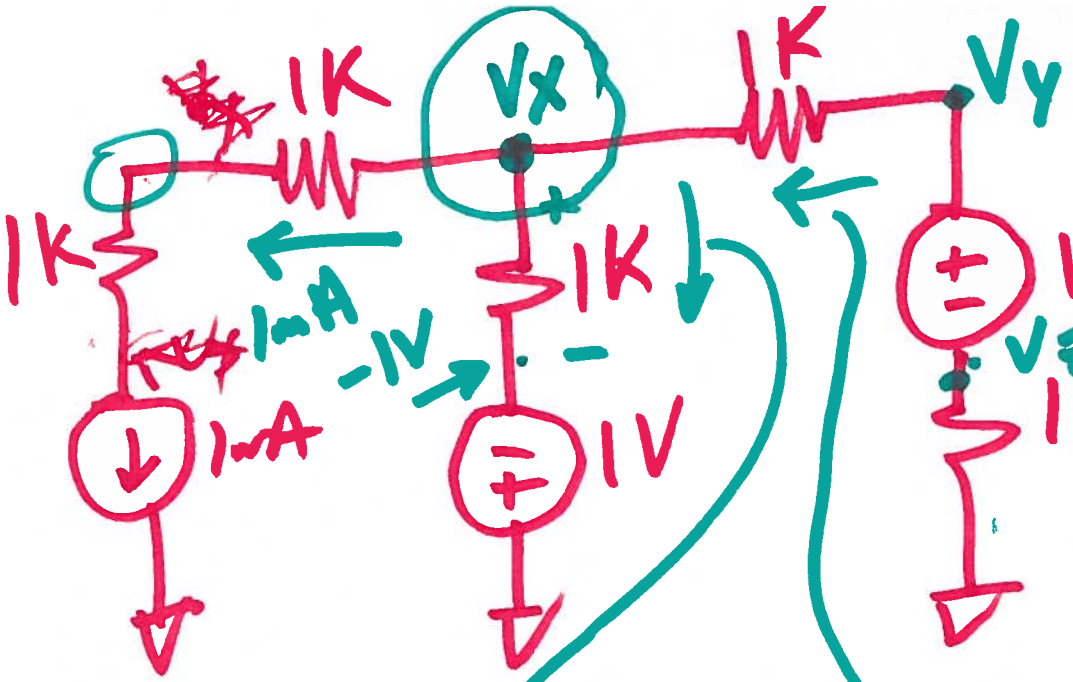


$$I_T = 9mA + (-9mA) = 0$$

$$I = \frac{0-9}{1K} = -9mA$$







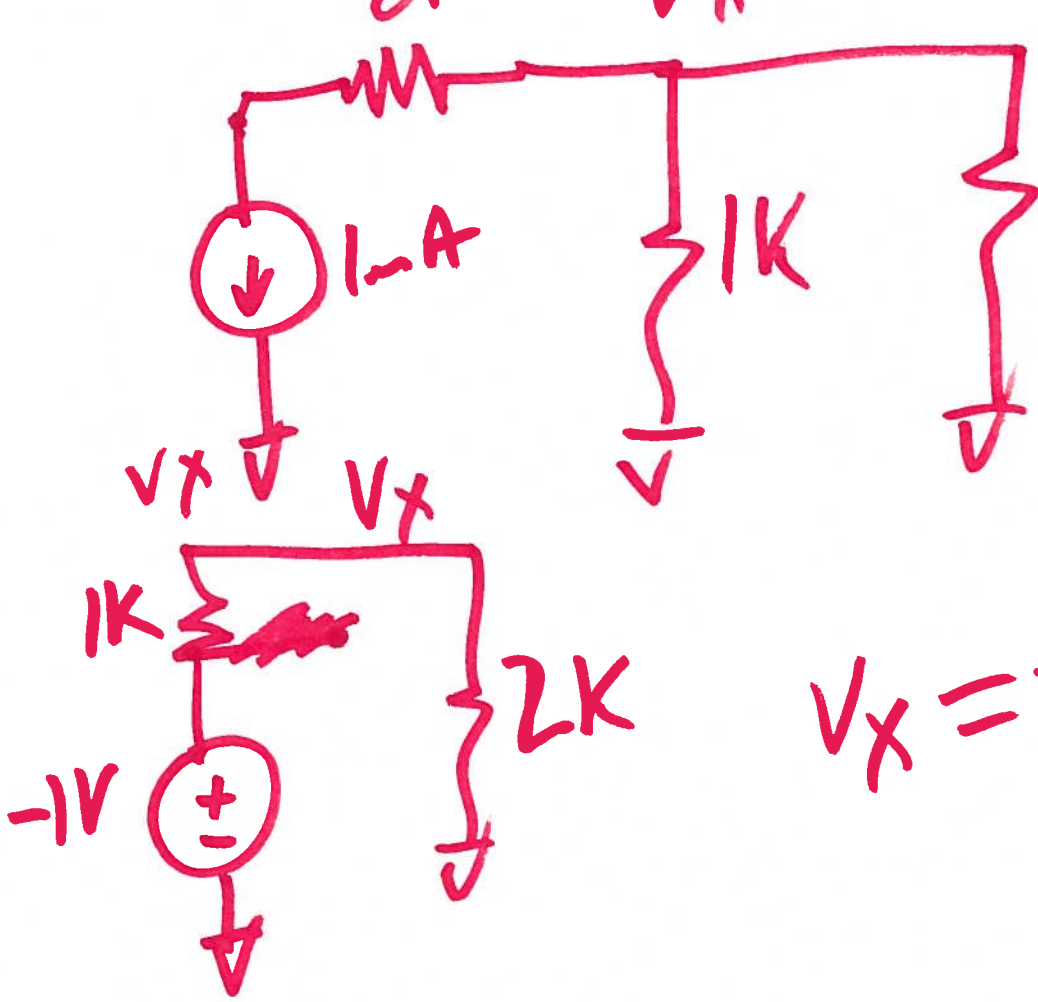
$$\frac{V_x-(-1)}{1K}$$

$$\frac{V_y-V_x}{1K}=\frac{0-V_z}{1K}$$

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

$$V_y-V_z=1$$

$$V_z=V_y-1$$



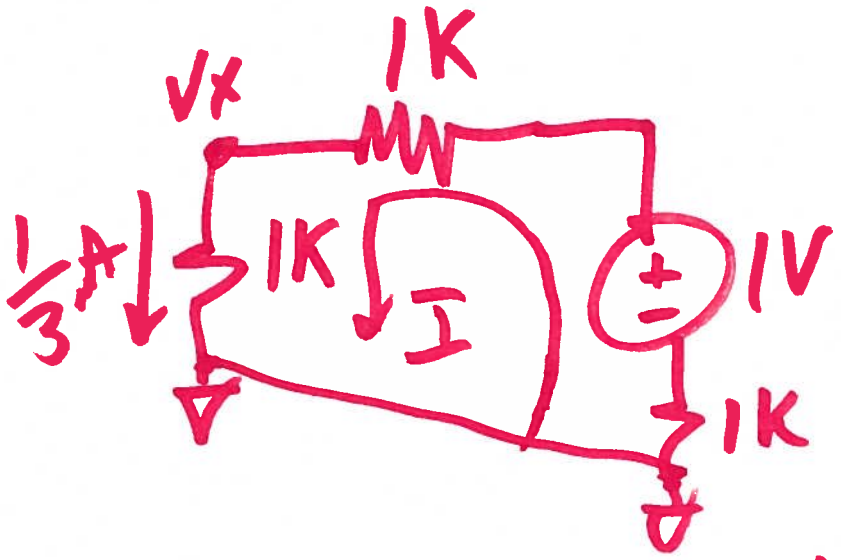
$V_x = 1mA \cdot (1K \| 2K) = \frac{2}{3} V$

$0.6667K\Omega$

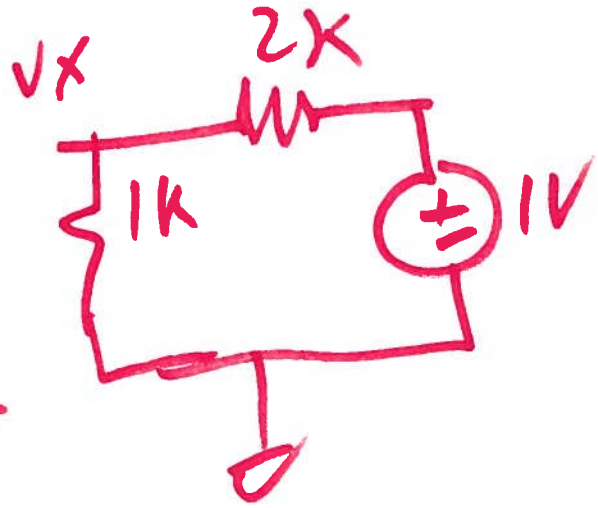
$\frac{2}{3}K\Omega \quad 666.7\Omega$

$\frac{2K \cdot 1K}{2K+1K} = \frac{2}{3}K$

$V_x = -1V \cdot \frac{2K}{1K+2K} = -\frac{2}{3}V$



$$V_x = 1V \cdot \frac{1K}{2K+1K} = \frac{1}{3}V$$

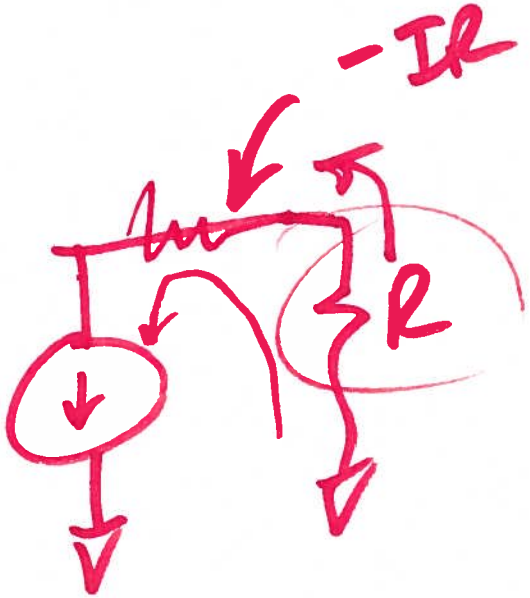


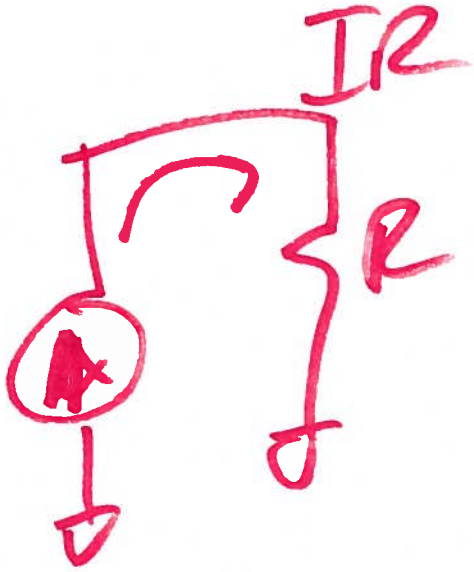
$$\frac{1V}{3K} = I = \frac{1}{3}mA$$

$$V_x = \frac{1}{3}mA \cdot 1K = \frac{1}{3}V$$

$$-\frac{2}{3} - \frac{2}{3} + \frac{1}{3} = -1V$$


60psi
-60psi


-IR
R


IR
R

Power.

Resistor

$P = I \cdot V = \frac{V_S}{R_1+R_2} \cdot R_2 \cdot \frac{V_S}{R_1+R_2}$

I

$R_1 = R_2$

V

Power

$\left(\frac{V_S}{R_1+R_2} \cdot R_2\right)$ =