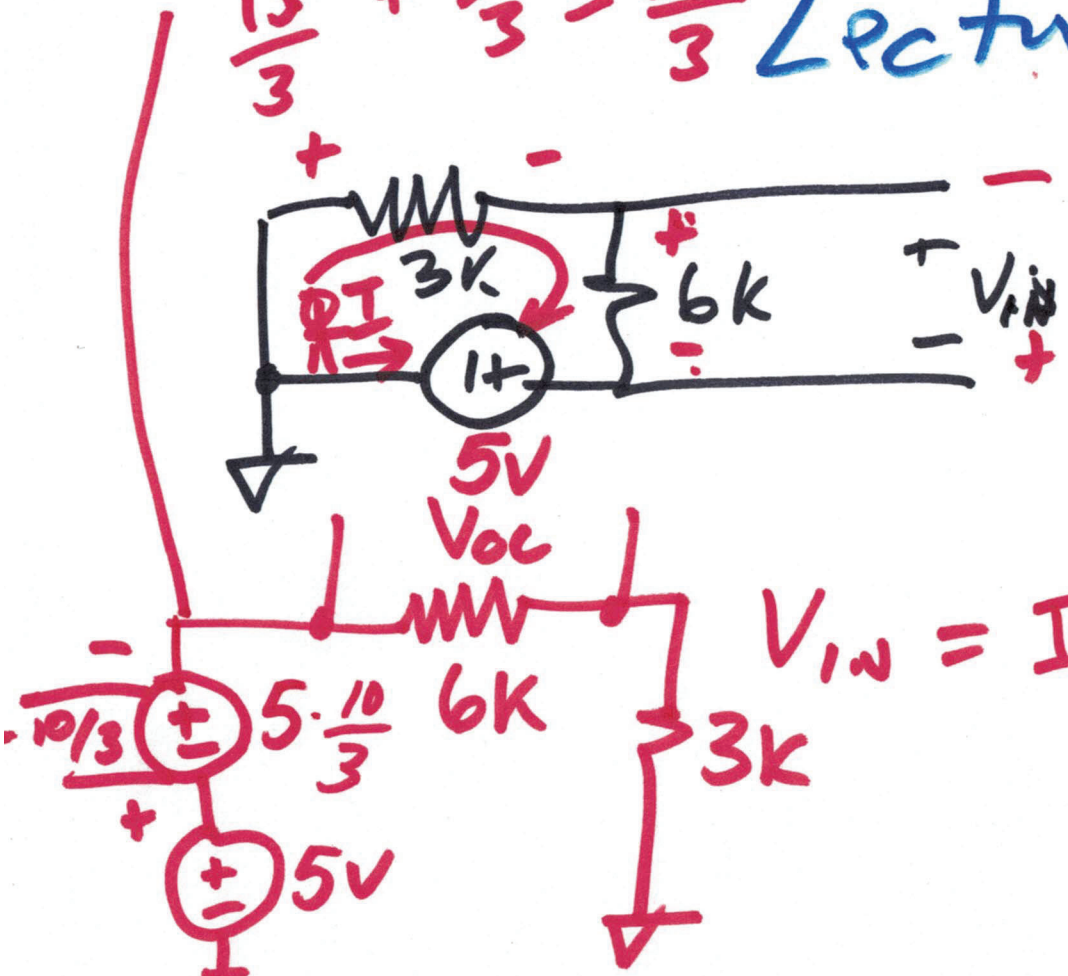
# EE 220 Circuits I

## Oct. 11, 2023

## Lecture 13, 2023

$5 + 5\cdot\frac{10}{3} = \frac{15}{3} + \frac{50}{3} = \frac{65}{3}$ V

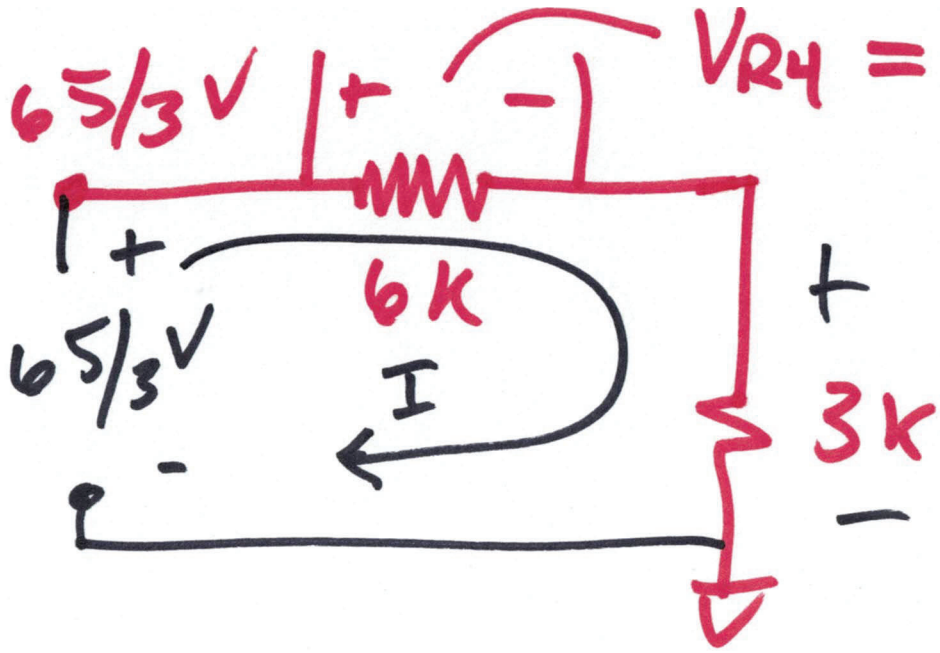



$5 + I6k + I\cdot 3k = 0$

$I = -\frac{5}{9}$ mA

$V_{IN} = I\cdot 6k$, $V_{IN} = \frac{-5}{9}(6)$

$$\boxed{V_{IN} = -\frac{10}{3}\text{ V}}$$




$V_{R4} = V_{OC} = V_{THV}$

$V_{R4} = \frac{65}{3} \cdot \frac{6K}{3K+6K}$

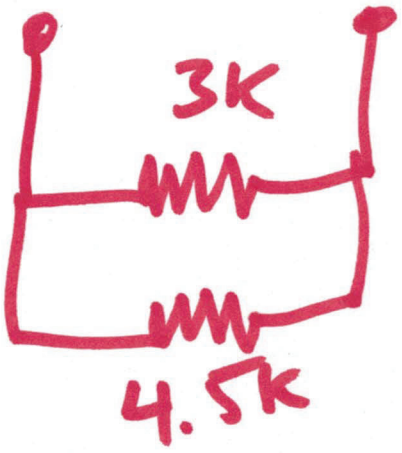
$\frac{65}{3} - 6KI - 3kI = 0$

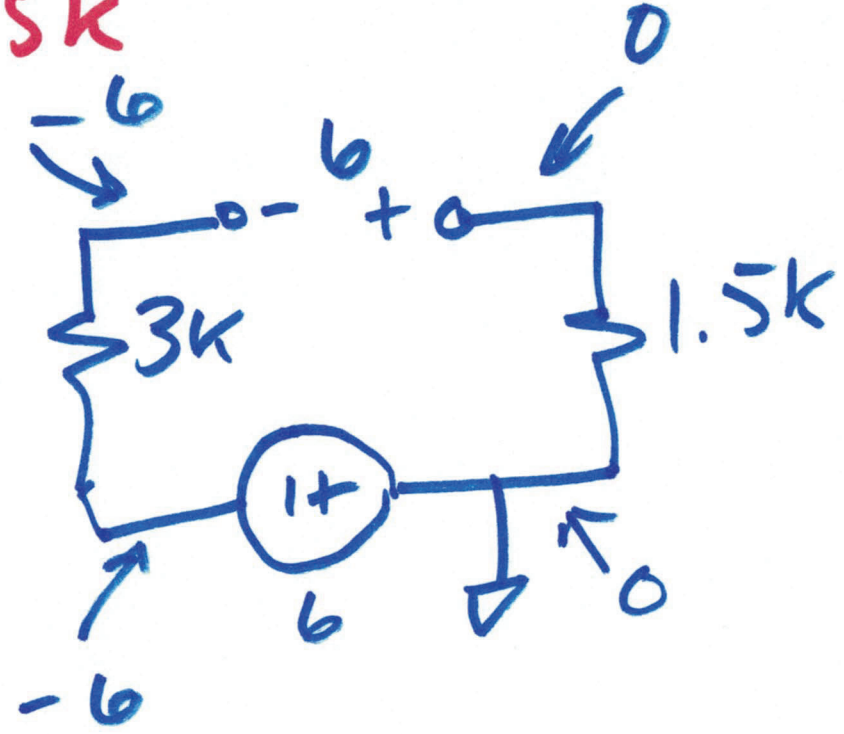
$I = \frac{65}{3 \cdot 9}\ mA$

$V_{R4} = 6KI = \frac{6K \cdot 65}{3 \cdot 9}\ V$

$= \frac{130}{9}\ V = 14\frac{4}{9}\ V$

$3k \| 4.5k = R_{TH}$

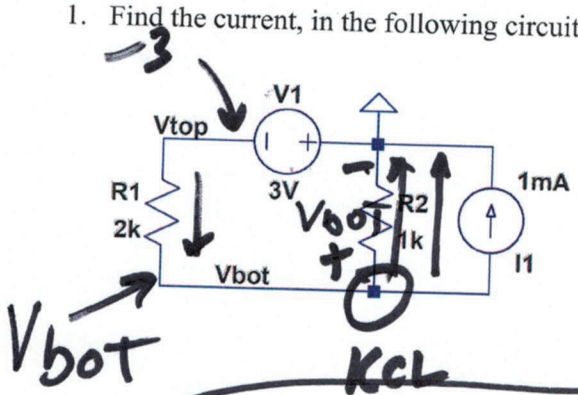



Midterm Exam – EE 220 Circuits I
Fall 2022 – University of Nevada, Las Vegas

NAME: _____

Closed book and notes.
**Show your work for credit and put a box around your answers.**

1. Find the current, in the following circuit, that flows in R2. (10 points)




$$1mA + \frac{V_{bot}}{1k} = \frac{-3 - V_{bot}}{2k}$$

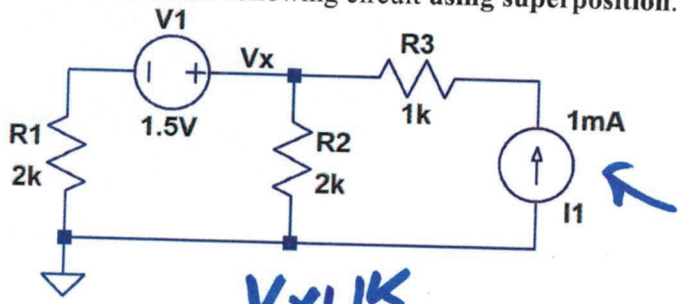
$$2V + 2V_{bot} = -3 - V_{bot}$$

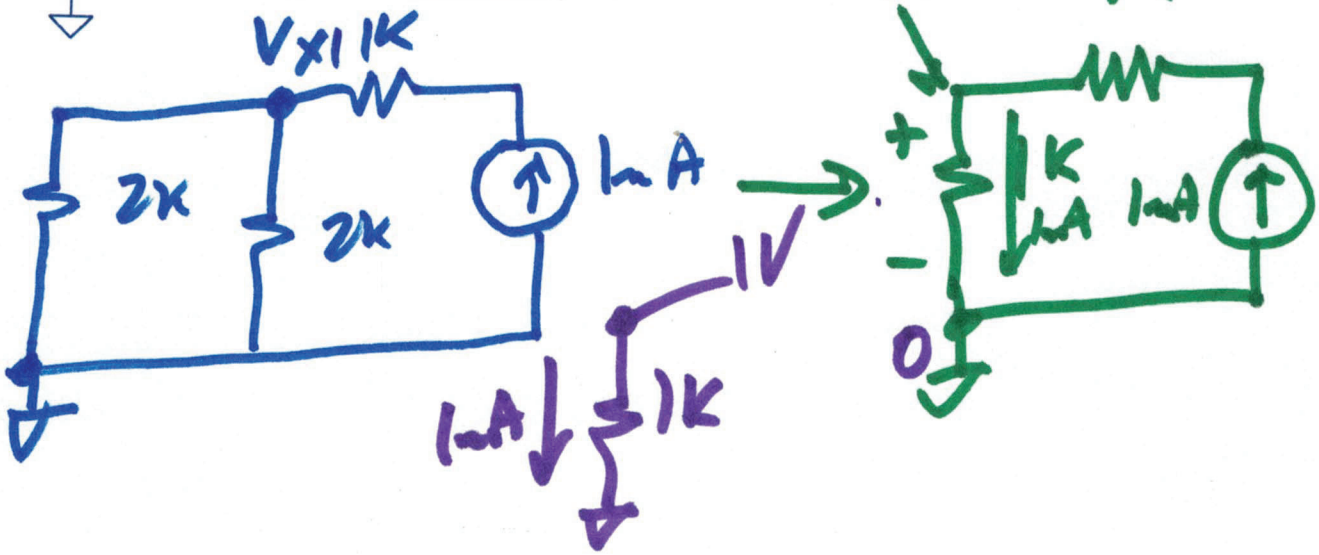
$$V_{bot} = \frac{-5V}{3}$$

KCL

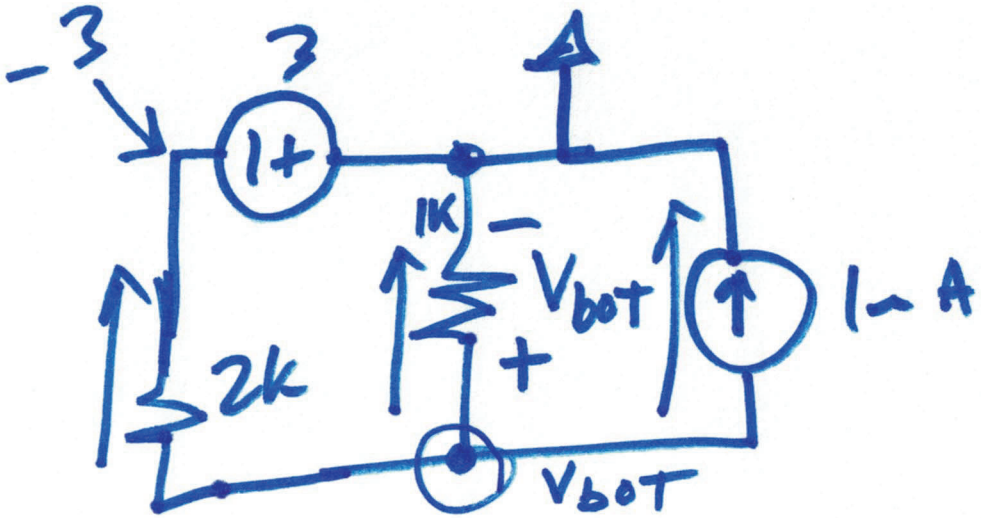
$$I_{R2} = \frac{-5}{3\,1k} = \frac{-5}{3}\,mA$$

2. Find Vx in the following circuit **using superposition**. (10 points)

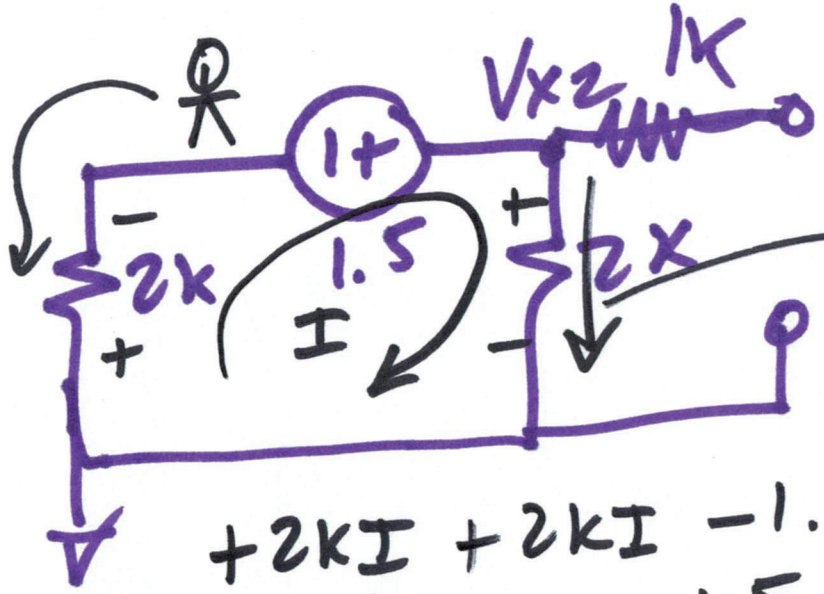



4)




KCL $\quad 0 = 1mA + \frac{V_{DOT}-0}{1k} + \frac{V_{DOT}-(-3)}{2k}$




$V_{x2} = 2k \cdot \frac{3}{8}mA$

$= \frac{6}{8}V$

$\frac{3}{8}mA = \frac{3}{4}V$

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

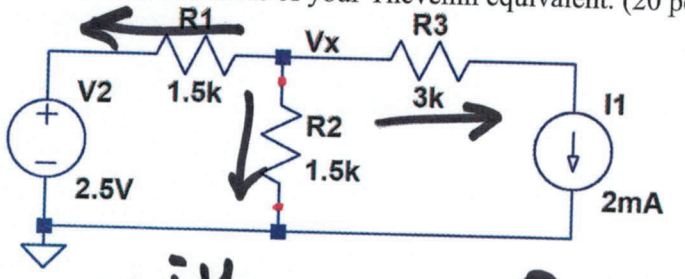
$+2kI + 2kI - 1.5 = 0$

$\frac{3}{8}mA \quad I = \frac{1.5}{4k} = \frac{1.5}{4}mA \quad \frac{3}{8}mA$

$V_x = 1 + 0.75$

$\boxed{V_x = 1.75V}$

3. Find the voltage Vx in the circuit seen below. Then find the Thevenin equivalent circuit, with R2 removed, at the terminals marked by dots. Show that your Thevenin circuit is correct by comparing the value you calculated for Vx to the one you get when you put R2 across the terminals of your Thevenin equivalent. (20 points)

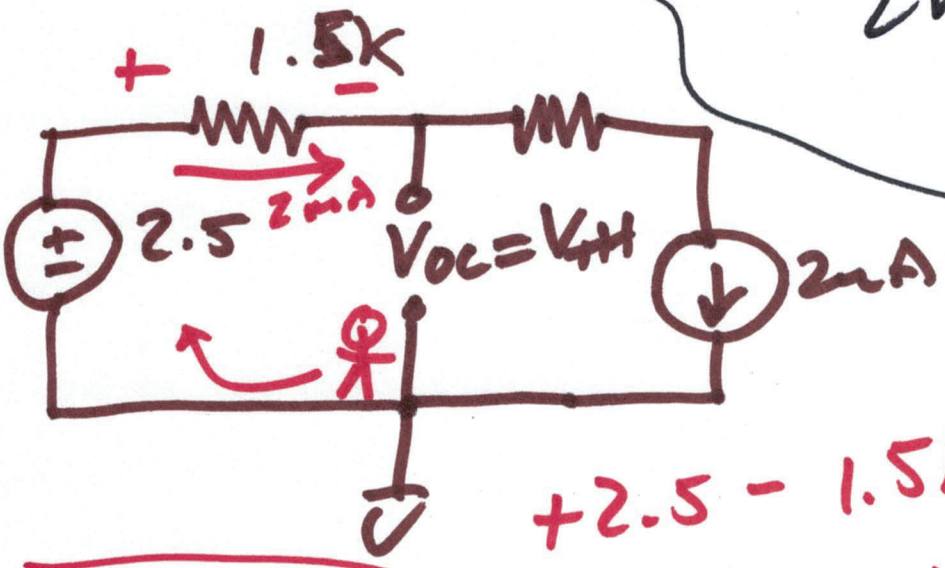



$$2mA + \frac{V_x}{1.5k} + \frac{V_x - 2.5}{1.5k} = 0$$

with R2: $0 = 3V + V_x + V_x - 2.5$

$$2V_x = -\frac{1}{2}$$

$$V_x = -\frac{1}{4}$$

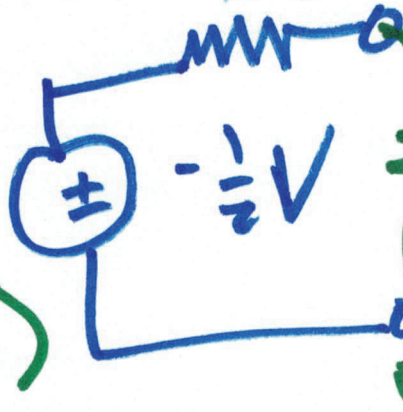



$$+2.5 - 1.5k(2mA) = V_{oc}$$

$$V_{oc} = 2.5 - 3$$

$$V_{THN} = V_{oc} = -\frac{1}{2}V$$

$R_{THN} = 1.5k$

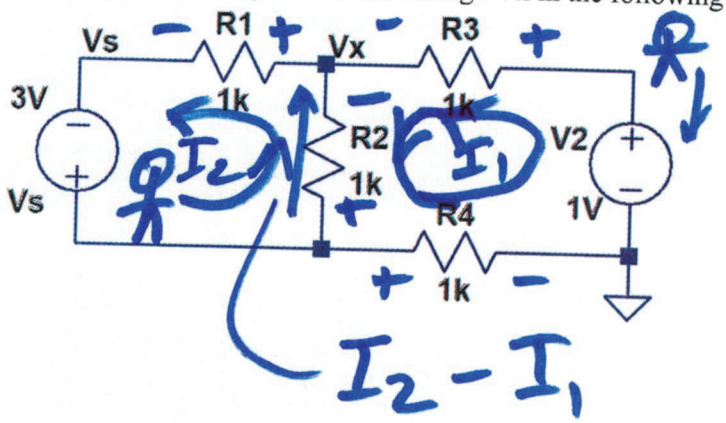



$$1.5k\ V = -\frac{1}{2} \cdot \frac{1.5k}{1.5k + 1.5k}$$

$$V = -\frac{1}{4}V$$

6)

4. **Using mesh analysis** find the voltage Vx in the following circuit. (20 points)

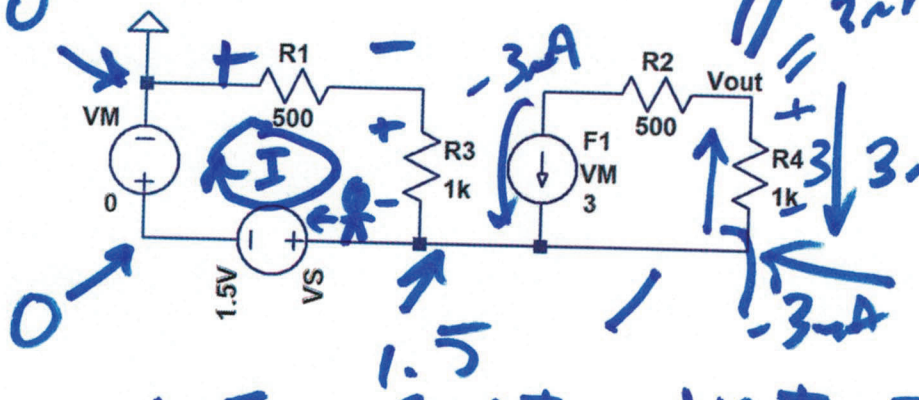



① $-1k(I_2 - I_1) - 1kI_2 + 3 = 0$

② $-1V + 1K I_1 - 1k(I_2 - I_1) + 1k I_1 =$

7)

5. Find Vout in the following circuit. (20 points)




$-1.5 - 500I - 1kI = 0$

$I = \frac{-1.5}{1.5k} = -1mA$

$V_{OUT} = 1.5 + 3$

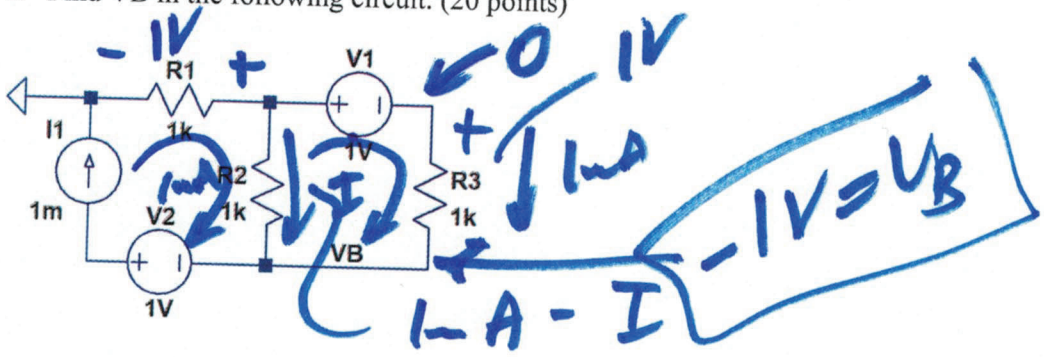
$V_{OUT} = 4.5V$

OR

$V_{OUT} = 4.5V$

8)

6. Find VB in the following circuit. (20 points)




9)