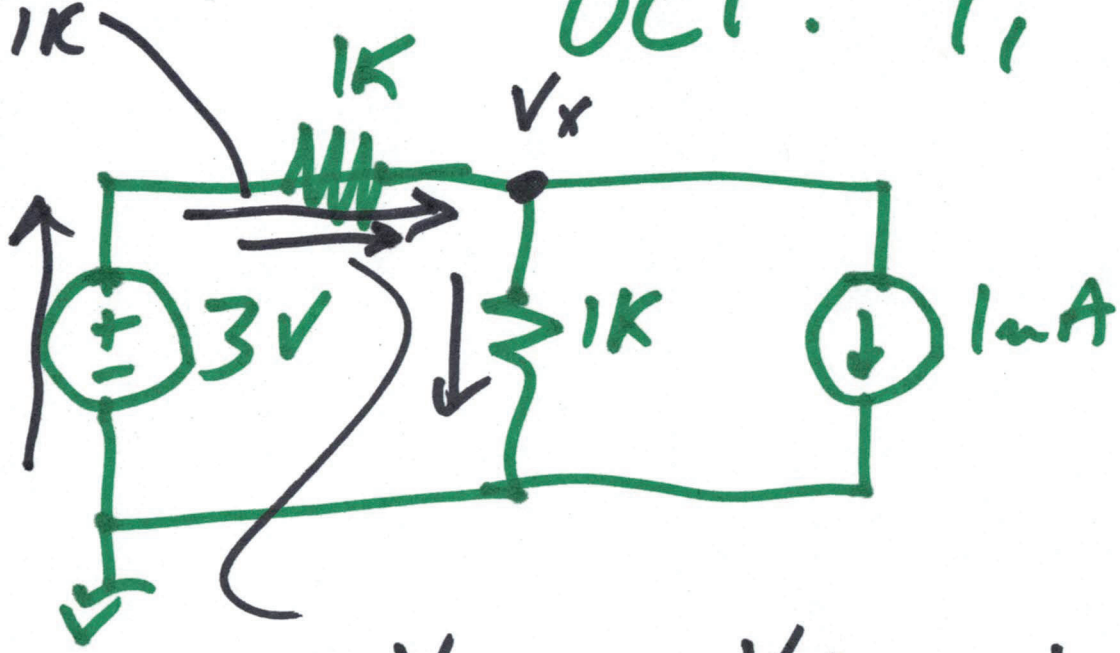
# EE 220 circuits I

## Lecture 13

## OCT. 7, 2020

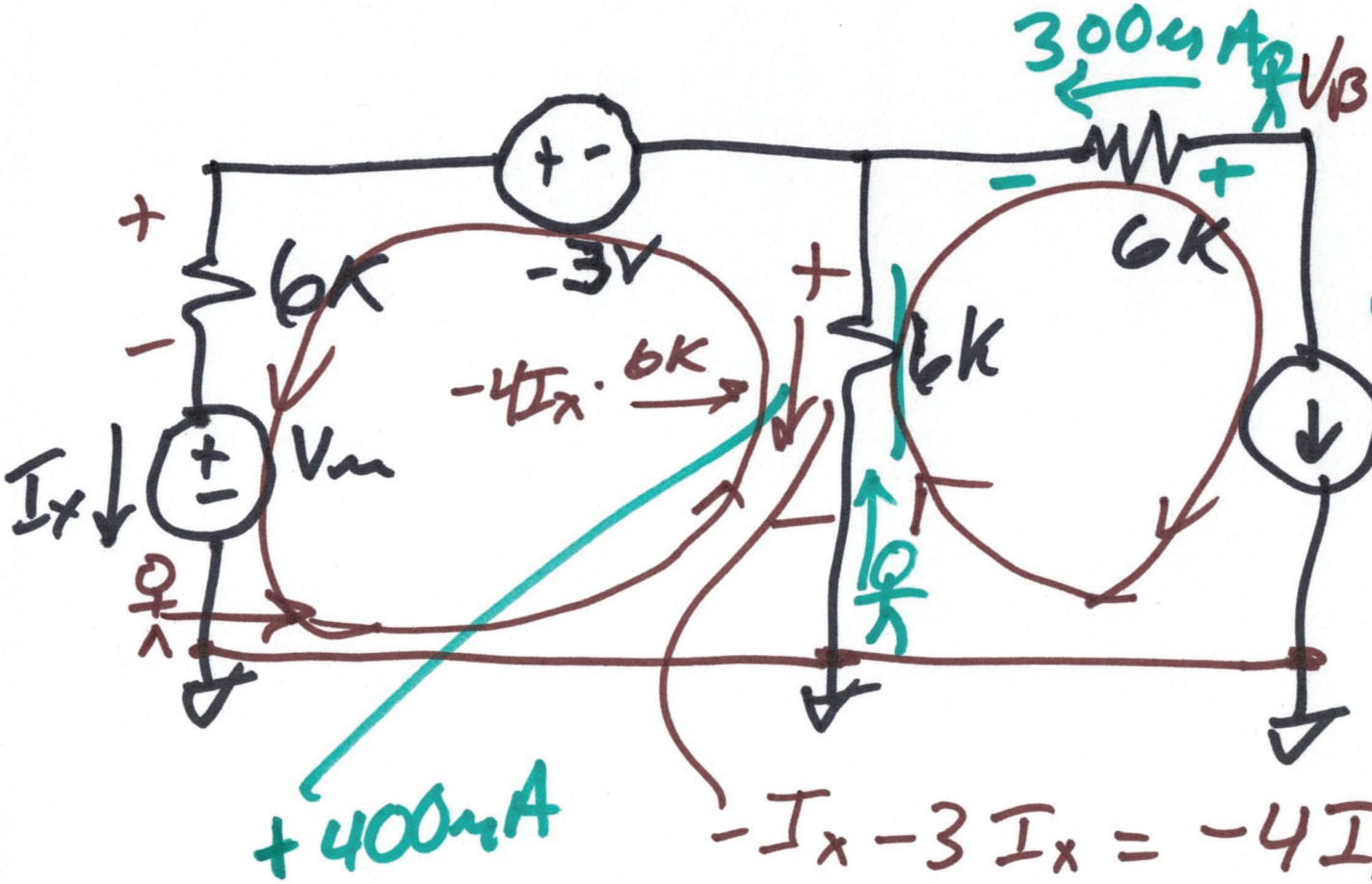
$\frac{3-1}{1K} = 2mA$




$$\frac{3-V_x}{1K} = \frac{V_x}{1K} + 1mA$$

$$3 - V_x = V_x + 1$$

$$V_x = 1$$




2.4
1.8

$-300\mu A \cdot 4.2V$

$V_B =$

$3 \cdot I_x$ -.6V

~~600μV~~

$+6K \cdot (+400\mu A)$

$+ 300\mu A \cdot 6K$

$= V_B$

$-I_x - 3I_x = -4I_x$

$+(-4I_x \cdot 6k) + (-3V) - 6kI_x = 0$

$-5I_x \cdot 6K = 3V$

$-5I_x = \frac{1}{2}mA = 500\mu A$

$I_x = \pm 100\mu A$

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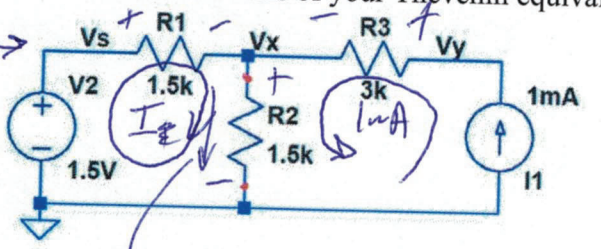
2)

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)

1.5



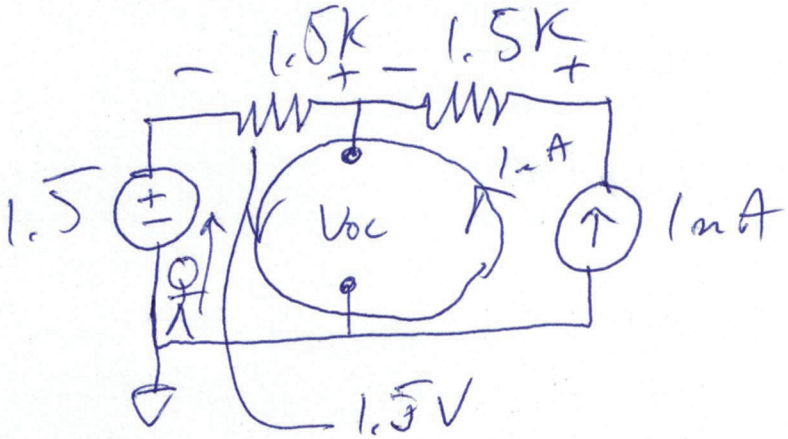

$I + 1mA$

$1.5 - 1.5K \cdot I - 1.5K(I + 1mA) = 0$

$1.5 - 3KI - 1.5V = 0$

$I = 0$

$V_X = 1.5V$

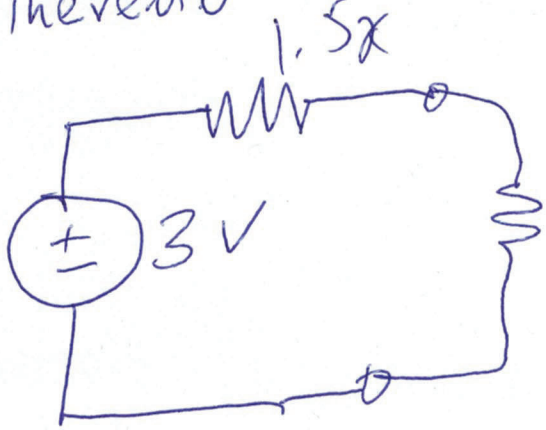



$R_{TH} = 1.5K$

$V_{OC} = 1.5 + 1.5$

$V_{OC} = V_{TH} = 3V$

Thevenin



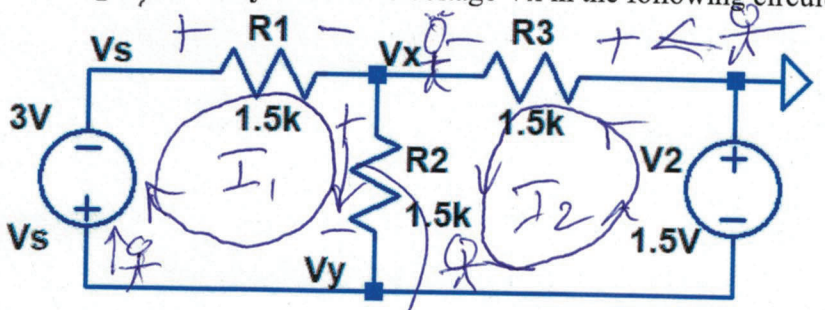

$$1.5K\ V_X = \frac{1.5K}{1.5K + 1.5K} \cdot 3$$

$V_X = 1.5V$

QED

3)

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




$V_x = -I_2 \cdot 1.5k$

$= -\frac{4}{3}mA \cdot 1.5k$

$V_x = -2V$

$I_1 + I_2$

$+1.5k(I_1 + I_2) + (3) + 1.5k \cdot I_1 = 0$

$+1.5k(I_1 + I_2) + (1.5) + 1.5k I_2 = 0$

$3k I_1 + 1.5k I_2 + 3 = 0$

$1.5k I_1 + 3k I_2 - 1.5 = 0$

$I_1 + \frac{1}{2} I_2 + 1mA = 0$

$I_1 = -\frac{1}{2} I_2 - 1mA$

$I_1 = -1\frac{2}{3} mA$

$1.5k\left(-\frac{1}{2} I_2 - 1mA\right) + 3k\, I_2 - 1.5 = 0$

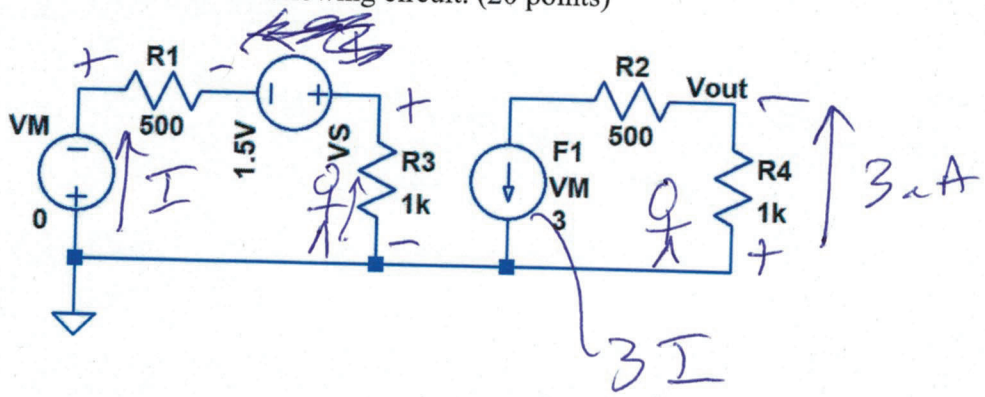
$-750 I_2 - 1.5V + 3k I_2 - 1.5 = 0$

$2.25k I_2 = 3$

$I_2 = 1\frac{1}{3} mA = \frac{4}{3}$

4)

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




$$1KI - 1.5 + 500 \cdot I = 0$$

$$1.5K \cdot I = 1.5$$

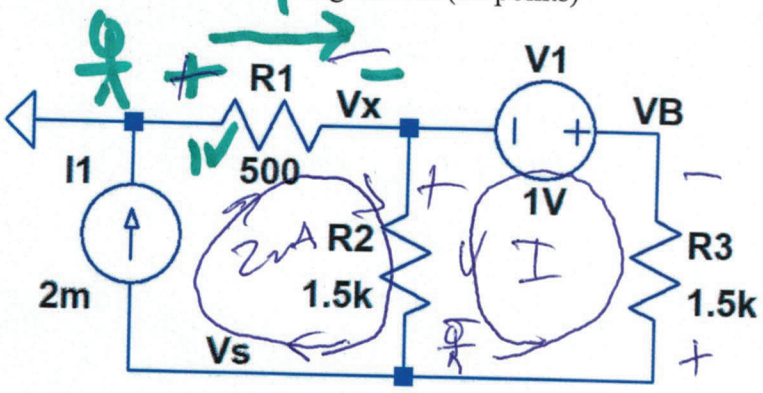
$$\boxed{I = 1mA}$$

$$V_{OUT} = -3mA \cdot 1K$$

$$\boxed{V_{OUT} = -3V}$$

5)

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




$$-1.5kI - 1V - 1.5k(2mA + I) = 0$$

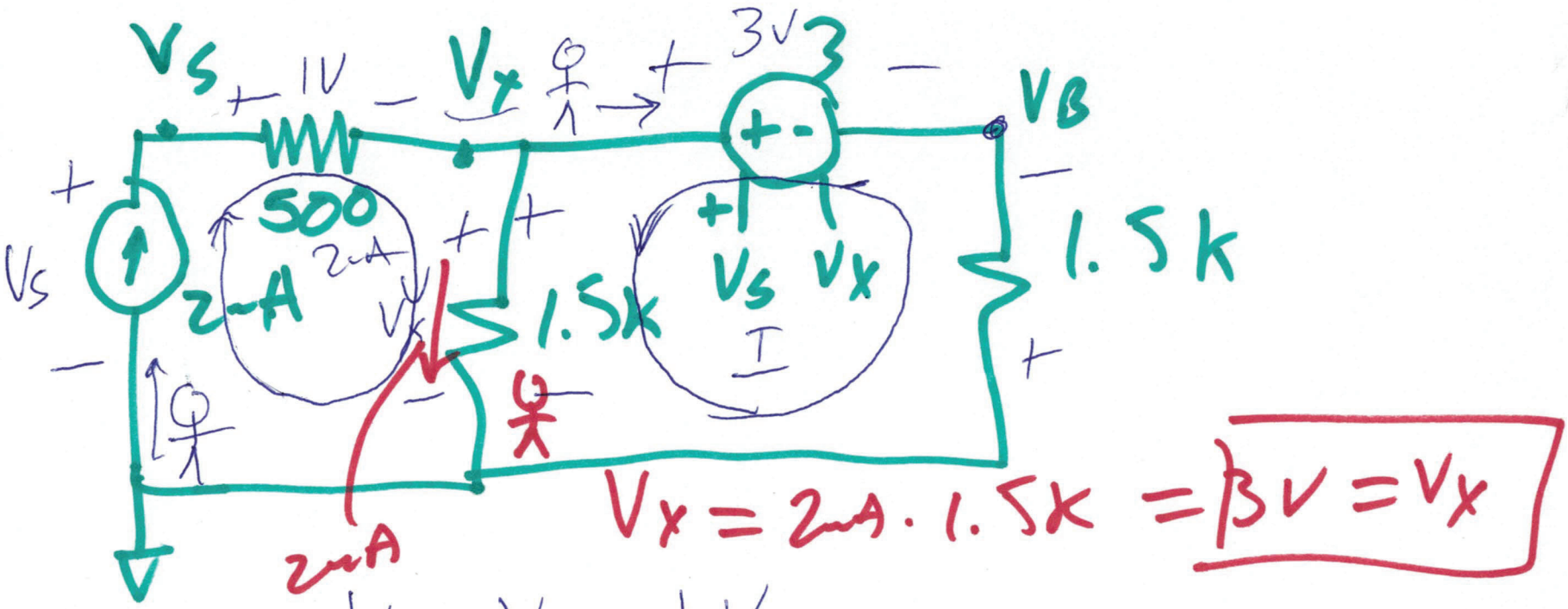
$$-3kI - 4 = 0$$

$$I = -1\frac{1}{3}\,mA$$

$$V_B = -1 + 1 = 0$$

$$\boxed{V_B = 0}$$

6)




$V_x = 2mA \cdot 1.5k = 3V = V_x$

$V_S = V_x = 1V$

$$-3(V_S - V_x) + 1.5K \cdot I + 1.5K(2mA + I) = 0$$

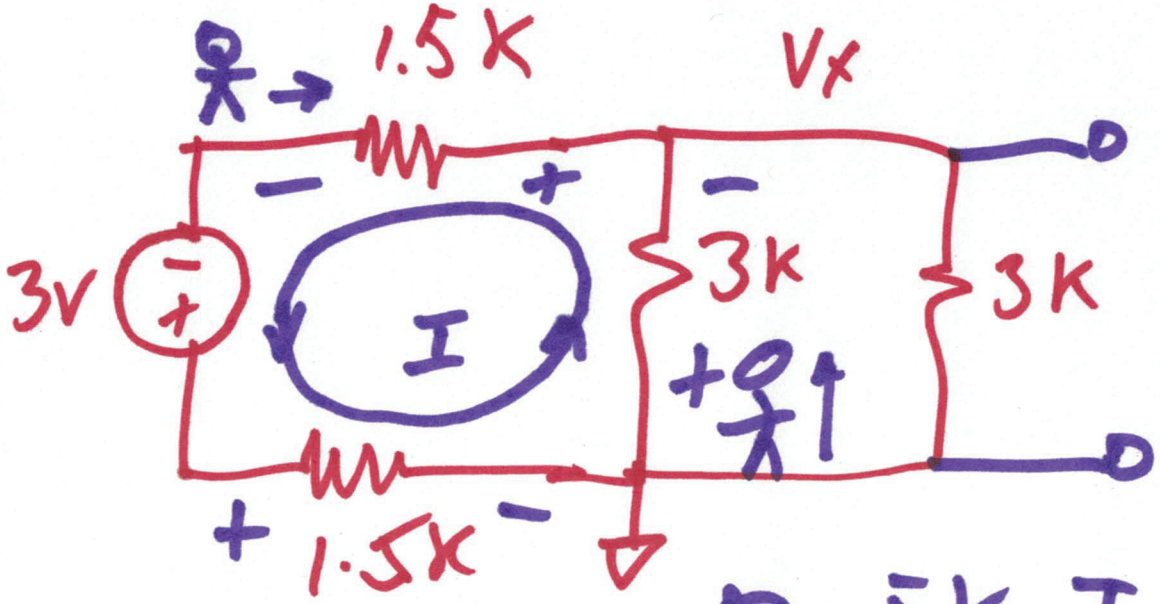
$$V_S - 500 \cdot 2mA - V_x = 0$$

$$V_S - V_x = 1V$$

$$-3 + 3 + 3K \cdot I = 0$$

$$I = 0$$

1)




$$-1.5k \cdot \frac{2}{3}mA = V_x$$

$$\boxed{V_x = -1V}$$

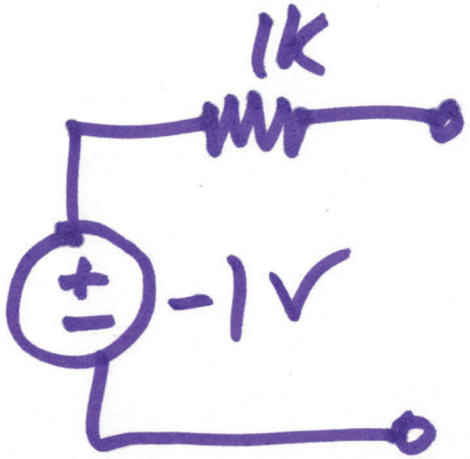
$$1.5k \cdot I + 1.5k \cdot I + 1.5kI - 3 = 0$$

$$4.5k \cdot I = 3$$

$$I = \frac{3}{3 \cdot 1.5k} = \frac{1}{\frac{3}{2}}mA$$

$$\boxed{I = \frac{2}{3}mA}$$

$$\boxed{R_{TH} = 1K\Omega}$$

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3)