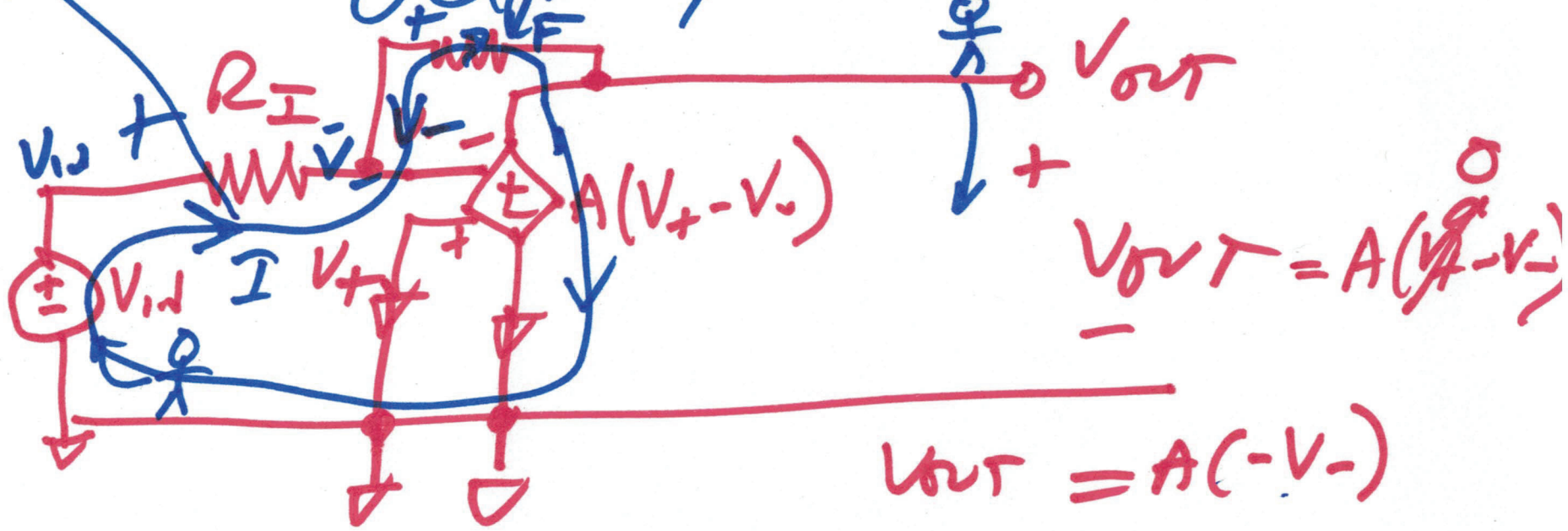
EE 220 circuits 1

Lecture 12

Oct 5, 2020



$$V_{IN} - IR_I - I \cdot R_f - V_{OUT} = 0$$

$$V_{IN} - I R_I - I \cdot R_f - V_{OUT} = 0$$

$$I = \frac{V_{IN} - V_-}{R_I}$$

$$V_{IN} - (V_{IN} - V_-) - \frac{R_f}{R_I}(V_{IN} - V_-) - V_{OUT} = 0$$

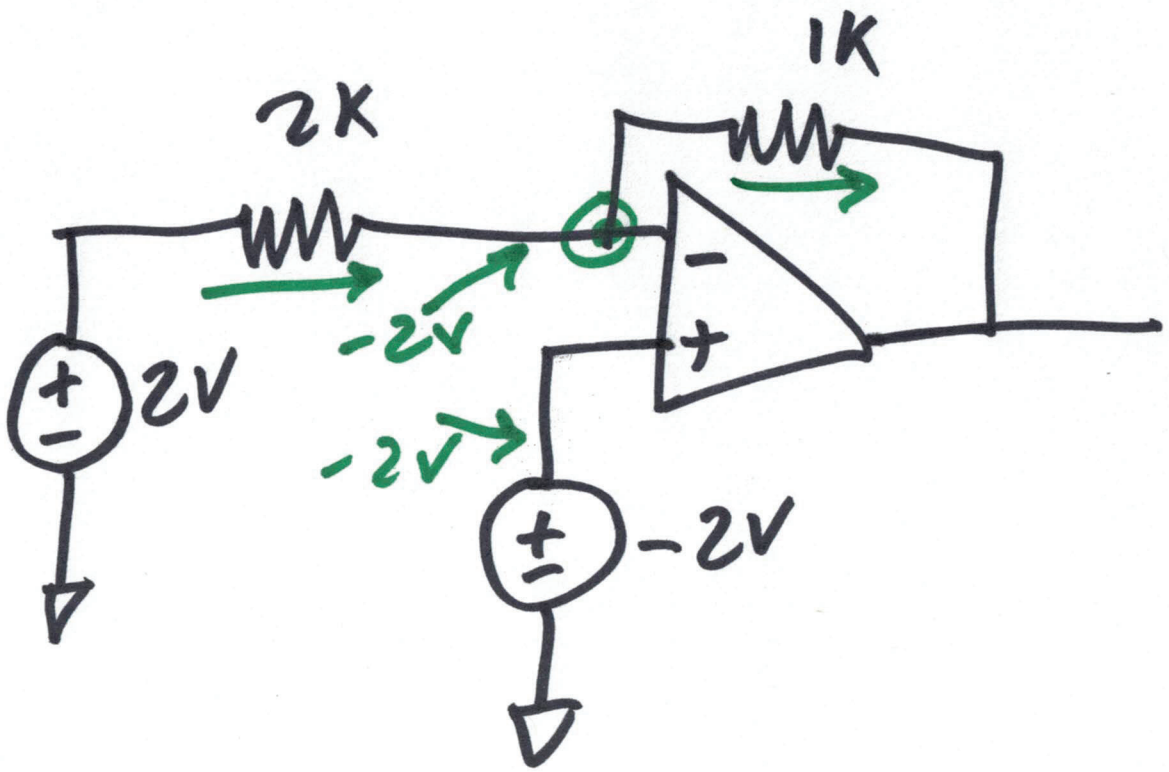
$$V_- = -\frac{V_{OUT}}{A}$$

$$V_{IN} - V_{IN} - \frac{V_{OUT}}{A} - \frac{R_f}{R_I} V_{IN} - \frac{R_f}{R_I}\frac{V_{OUT}}{A} - V_{OUT} = 0$$

($V_{IN} - V_{IN}$ and $\frac{V_{OUT}}{A}$ and $\frac{R_f}{R_I}\frac{V_{OUT}}{A}$ $\to 0$ as $A \to \infty$)

$$-\frac{R_f}{R_I} V_{IN} = V_{OUT}$$

$$\boxed{\frac{V_{OUT}}{V_{IN}} = \frac{-R_f}{R_I}}$$



1) find V_+ (NON-INVERTING)

2) $V_- = V_+$ (INVERTING)

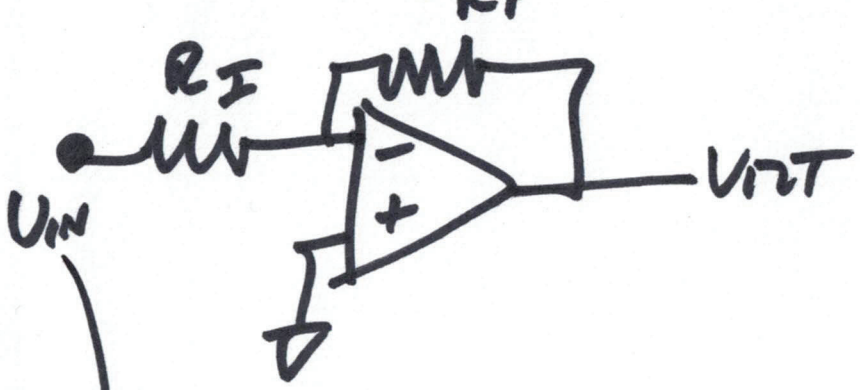
3) KCL @ V_-

$$\frac{2-(-2)}{2K} = \frac{-2-V_{OUT}}{1K}$$

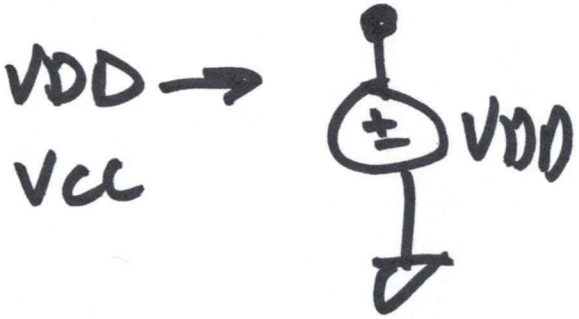
$$4 = -4 - 2V_{OUT}$$

$$V_{OUT} = -\frac{8}{4}V$$

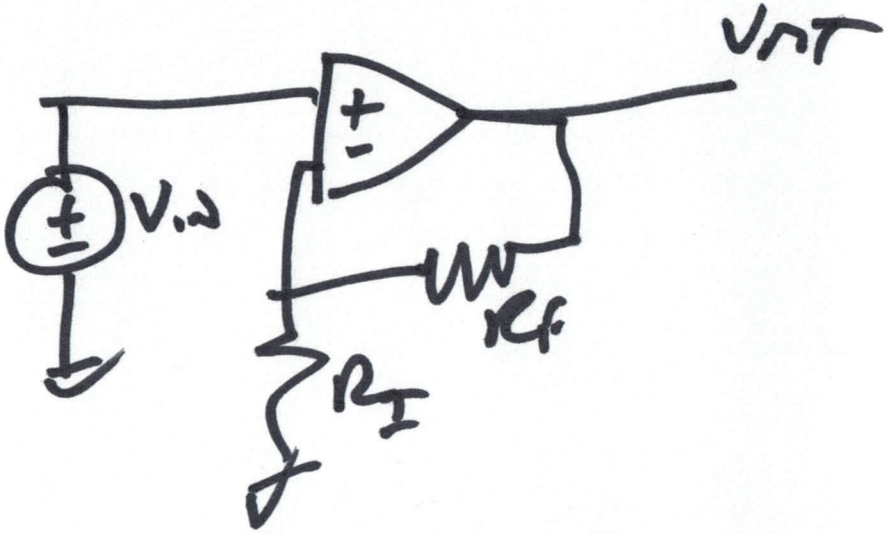
inverting



$$V_{OUT} = -V_{IN} \cdot \frac{R_F}{R_I}$$

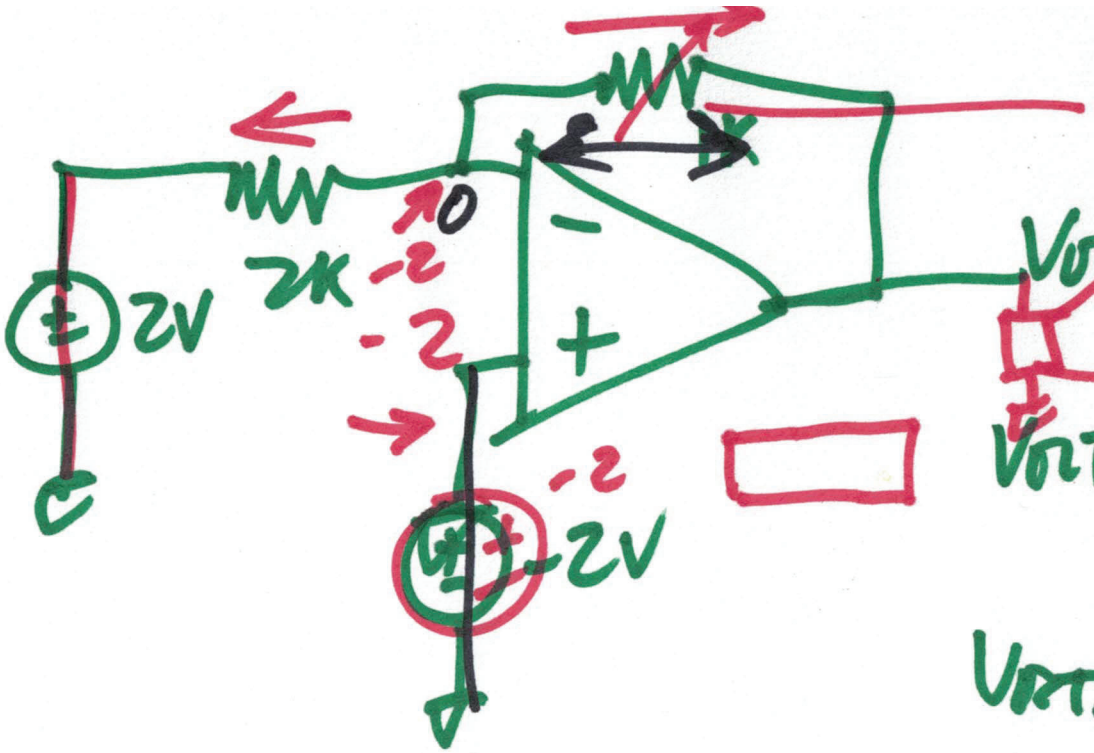


NON-INVERTING



$$\frac{V_{OUT}}{V_{IN}} = \frac{R_F}{R_I} + 1$$

$$= \frac{R_F + R_I}{R_I}$$



$$V_{OUT_1} = -2 \cdot \frac{1K}{2K} = -1V$$

$$V_{OUT_2} = -2 \cdot \left(1 + \frac{1K}{2K}\right)$$

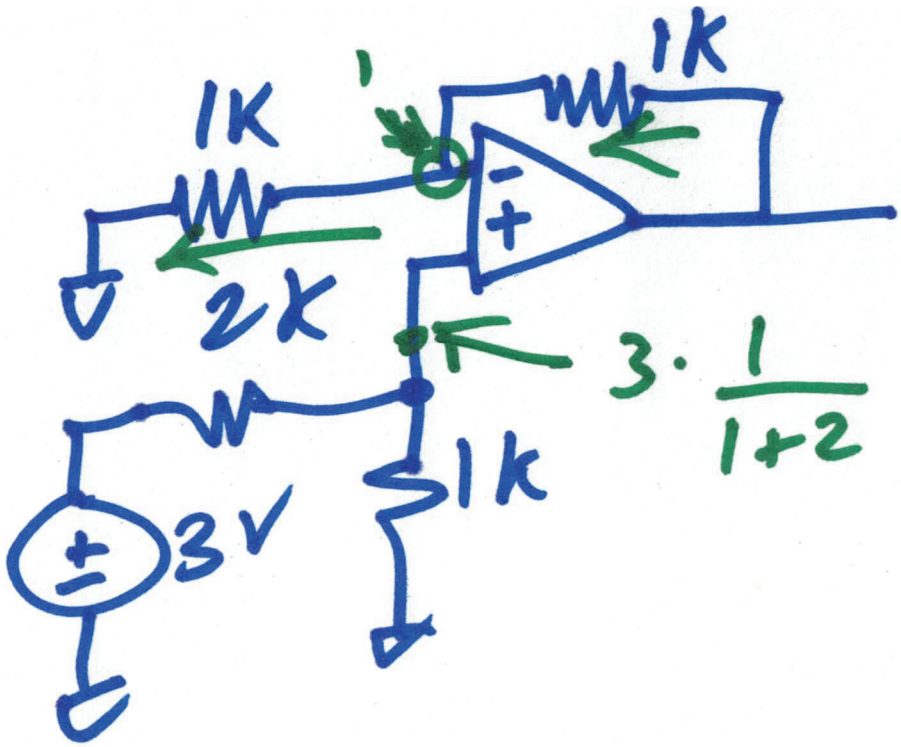
$$= -3V$$

$$V_{OUT} = -1 + -3$$

$$= -4$$

$$\frac{2-0}{2K} = \frac{0 - V_{OUT}}{1K}$$

$$\frac{-2-0}{2K} + \frac{0 - V_{OUT}}{1K}$$



$1\left(1+\frac{1K}{1K}\right)=2V$

V_{OUT}

1) find V_+

2) $V_+ = V_-$

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

Ideal op-Amp

$A_{OL} \to \infty$

$$\frac{1-0}{1K} = \frac{V_{OUT}-1}{1K}$$

$$V_{OUT} = 2V$$

6)

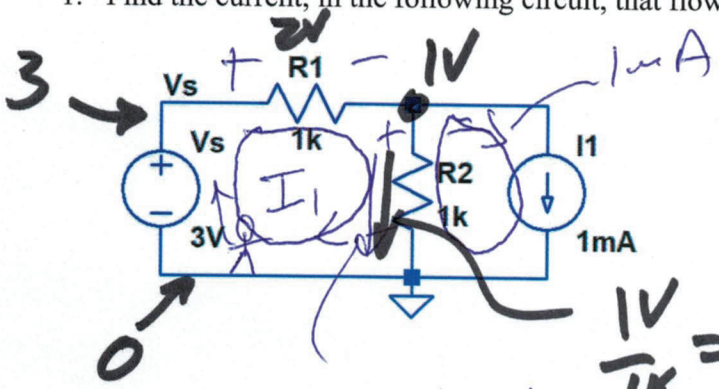
-6 μ (micro)
-3 milli
3 K
6 MEV
9 Giga

Midterm Exam – EE 220 Circuits I
Fall 2019 – 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 Vs. (10 points)



1mA

$3 - I_1 \cdot 1K - 1K(I_1 - 1mA) =$

$3 - 2KI_1 + 1V = 0$

$-2KI_1 = -4$

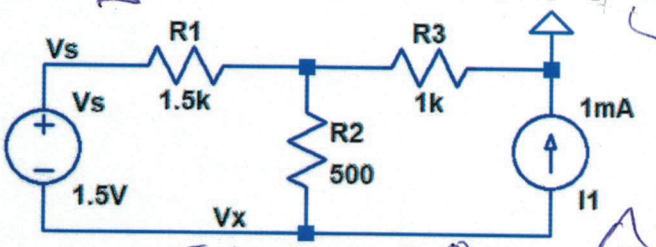
$I_1 = 2mA$

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

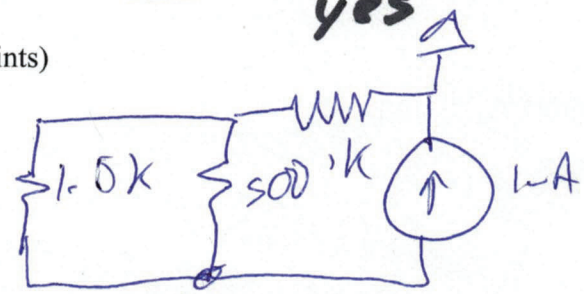
$I_1 - 1mA$

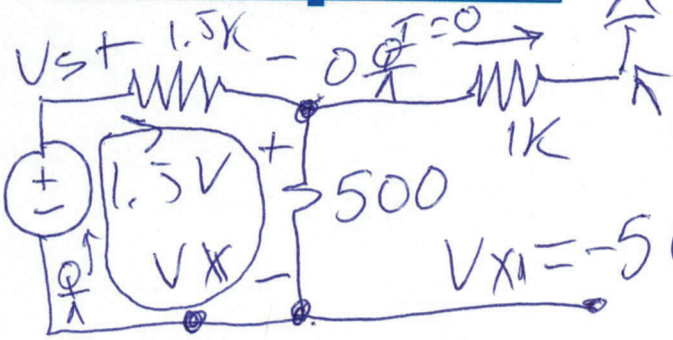
$I_1 = 0.002A$

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



yes





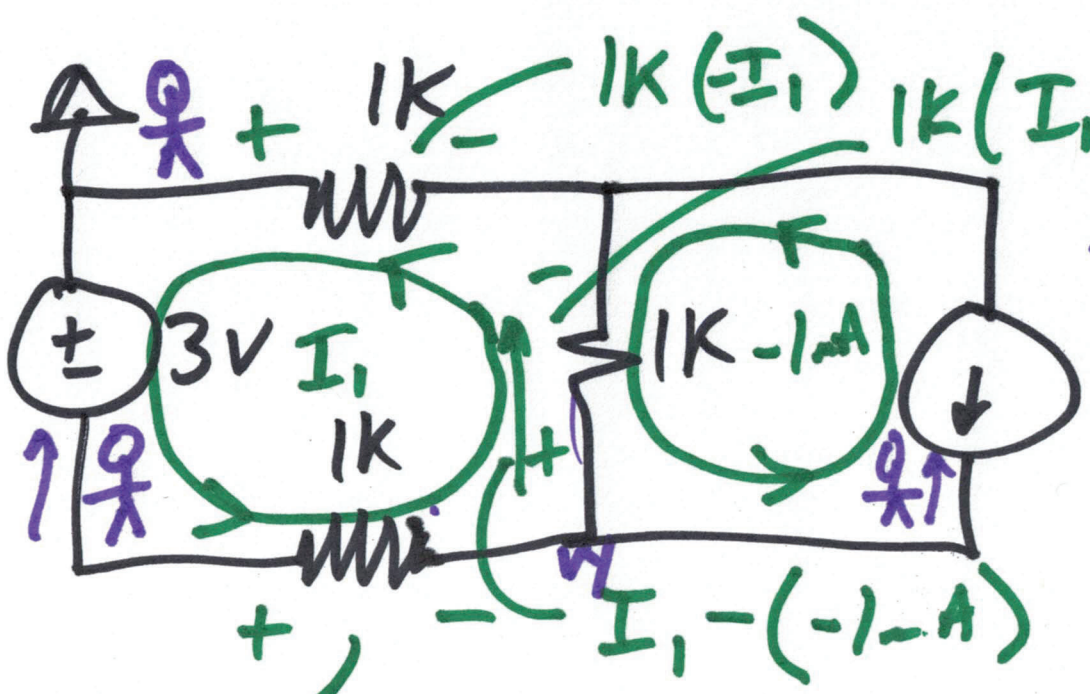
$1.5 - I \cdot 1.5k - I \cdot 500 = 0$

$1.5 = 2k \cdot I$

$I = \frac{3 \cdot \frac{1}{2}}{4 \cdot \frac{1}{4}} mA = 0.75mA = I$

$V_{x1} = -500 \cdot \frac{3}{4} mA = -375mV = V_{x1}$

7)



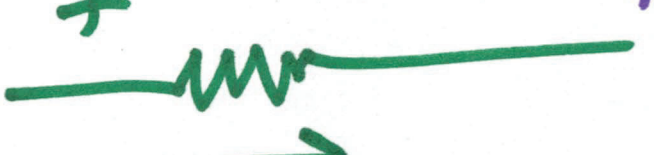
$V_1 + 1K(I_1 + 1mA) = 0$

$3 - (1K(-I_1)) + 1K(I_1 + 1mA) + I_1 \cdot 1K = 0$

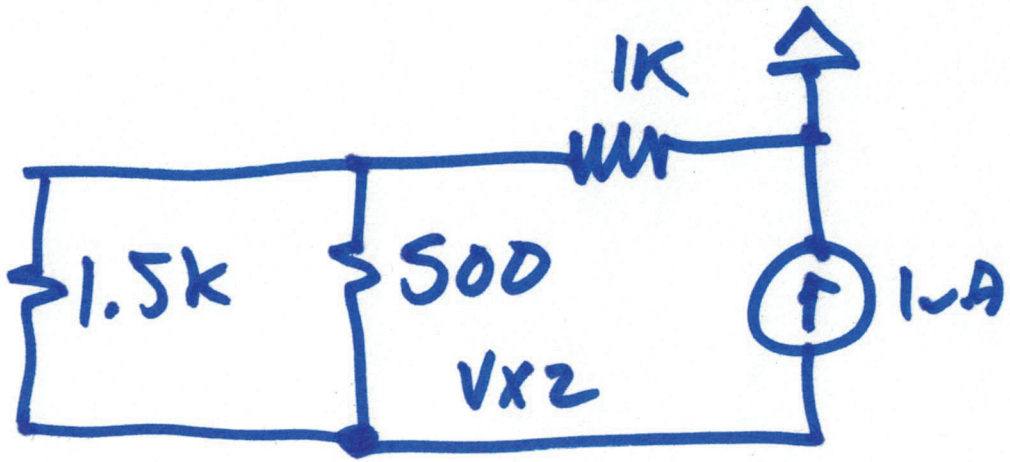
$V_y = ?$

$-3 - I_1 \cdot 1K$

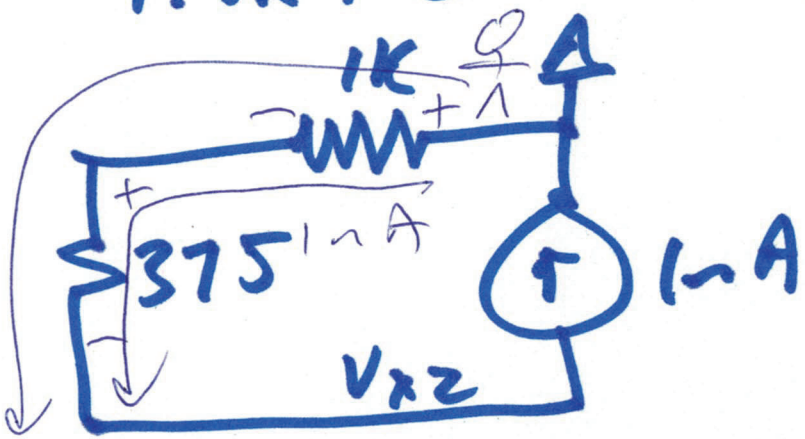
$V = -IR$



$V = IR$



$$\frac{1.5k \cdot 500}{1.5k + 500} = \frac{1,500 \cdot 500}{2000} = 375\Omega$$



$$V_{x2} = -1k(1mA - 1mA \cdot 375$$

$$= -1V - .375V$$

$$V_{x2} = -1.375$$

$$V_x = V_{x1} + V_{x2} = .375 - 1.375$$

$$= -1.75V$$