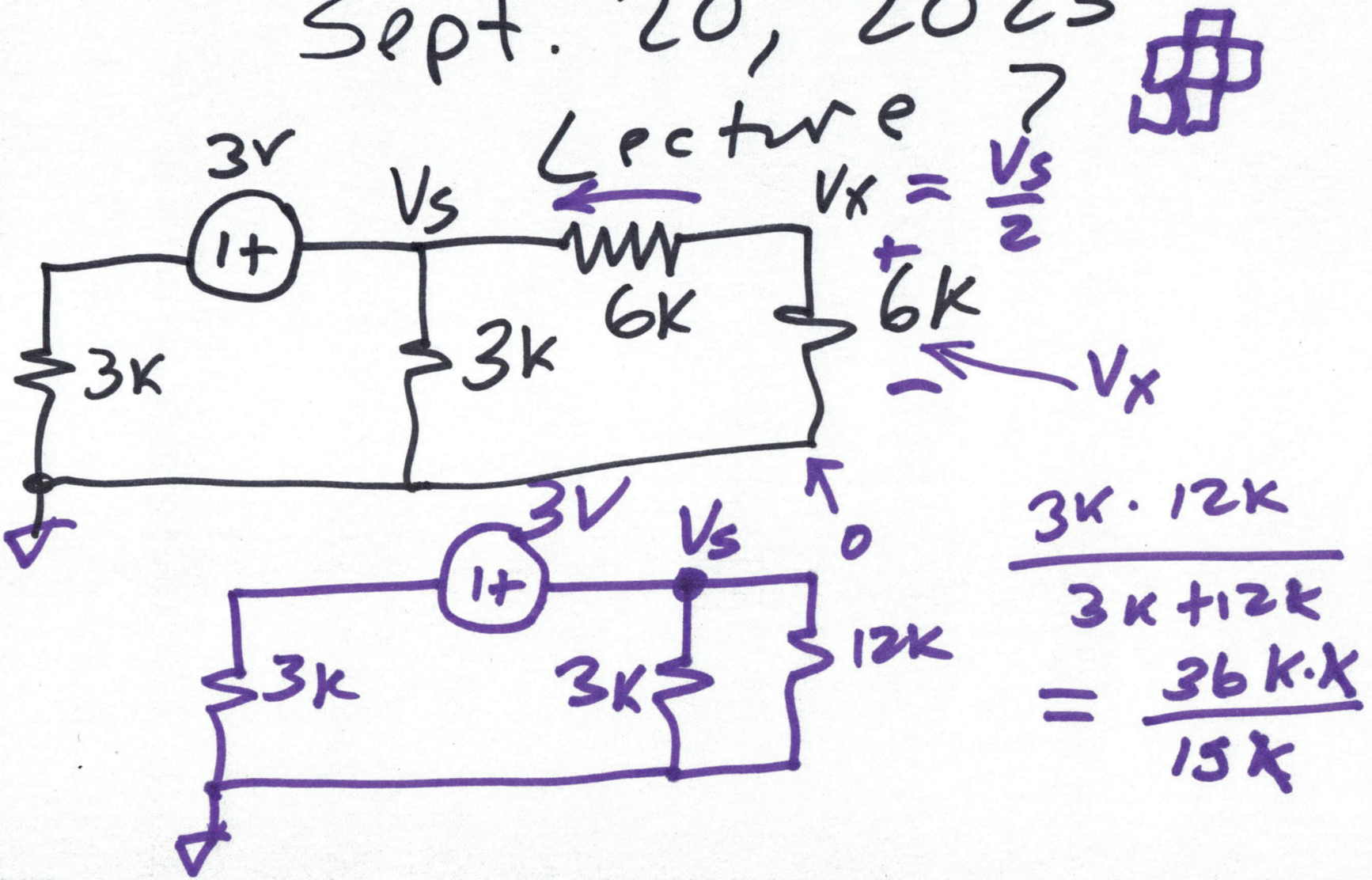
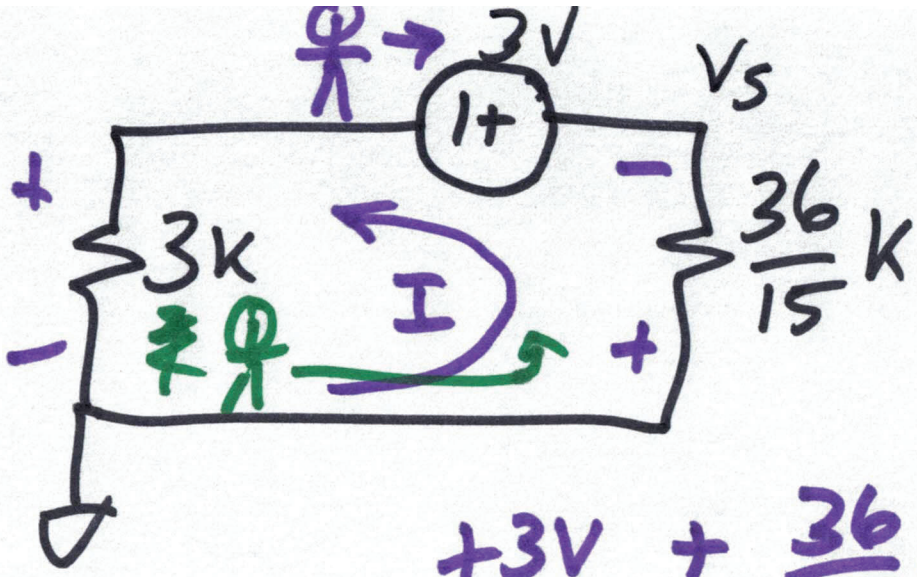
EE 220
Circuits I
Sept. 20, 2023
Lecture 7



$$\frac{3k \cdot 12k}{3k + 12k} = \frac{36k \cdot k}{15k}$$



$$-\frac{36}{15}k \cdot \frac{3}{45}mA = V_S$$

$$\frac{12}{9}V$$

$$+3V + \frac{36}{15}k \cdot I + 3kI = 0$$

$$-3 = \frac{36}{15}kI + \frac{45}{15}k \cdot I$$

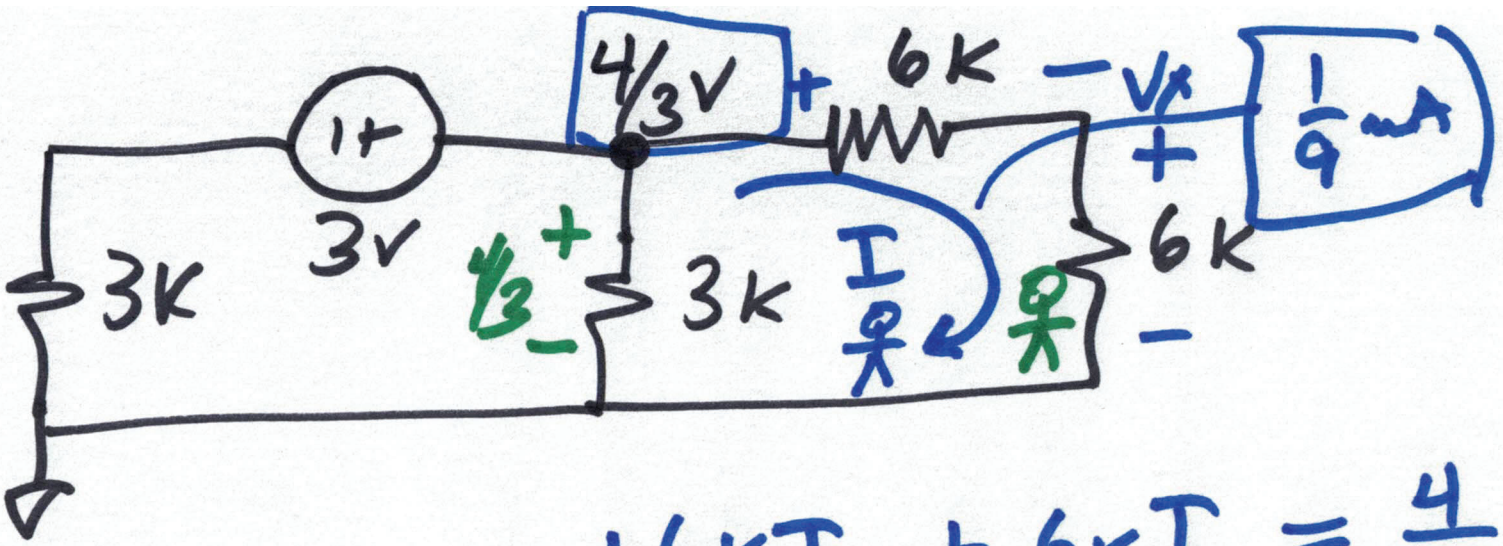
$$V_S = \frac{12}{9}V = \frac{4}{3}V$$

$$-3 = \frac{81k}{15} \cdot I$$

$$I = \frac{-45}{81k}$$

$$\boxed{V_S = \frac{4}{3}V}$$

$$\boxed{I = \frac{-45}{81}mA}$$



$$+6kI + 6kI = \frac{4}{3}V$$

$$+6kI + 6kI - \frac{4}{3}V = 0$$

$$12kI = \frac{4}{3}V$$

$$I = \frac{4}{3.12k}\,mA$$

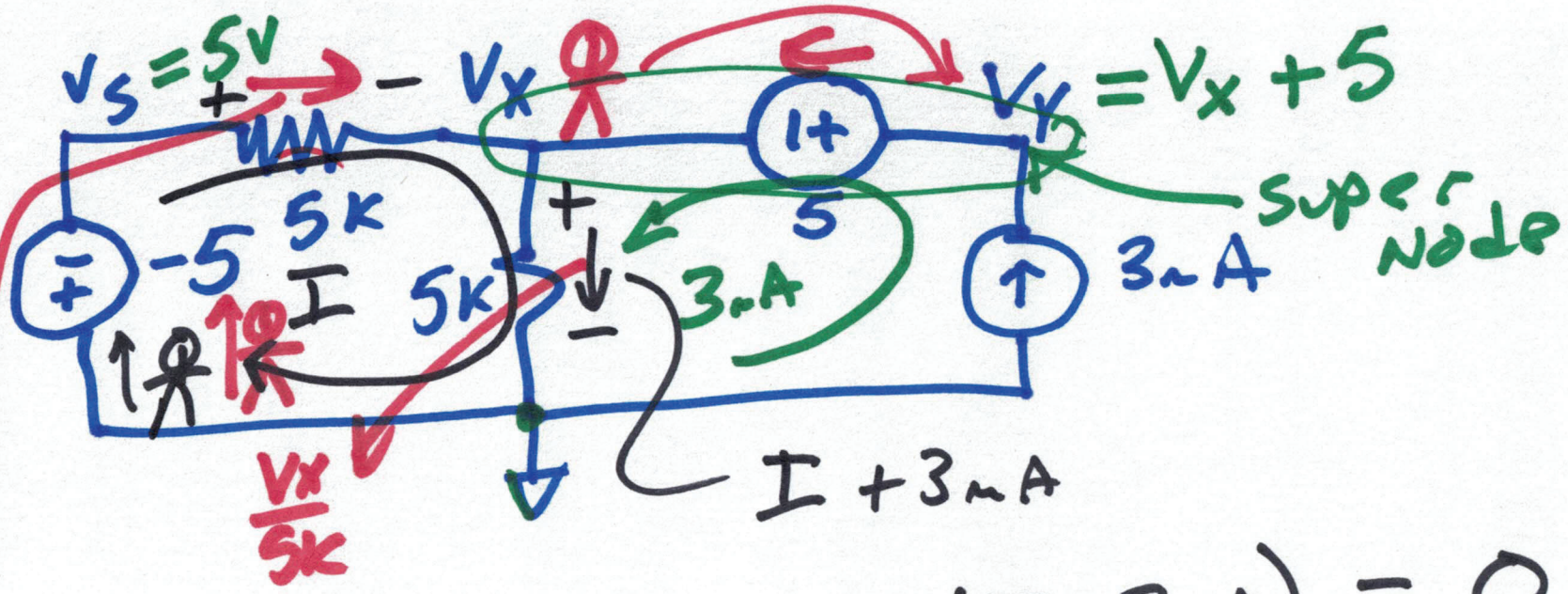
$$= \frac{4}{3.3.4}\,mA$$

$$I = \frac{1}{9}\,mA$$

$$V_x = \frac{1}{9}mA \cdot 6k$$

$$= \frac{6}{9}V = \boxed{\frac{2}{3}V = V_x}$$

3)

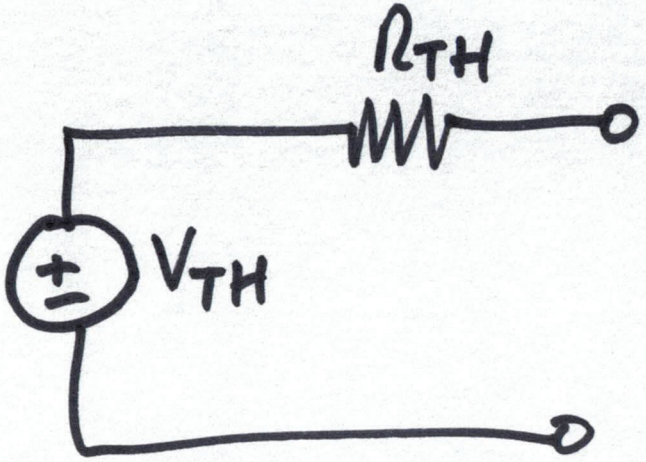


$$-(-5) - 5kI - 5k(I + 3mA) = 0$$

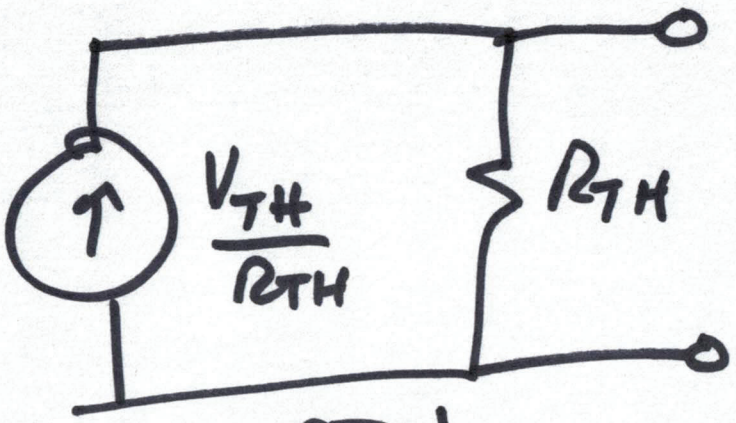
$$-(-5) - 5kI = V_X$$

$$-(-5) - 5kI + 5 = V_Y$$

$$\frac{5 - V_X}{5k}$$

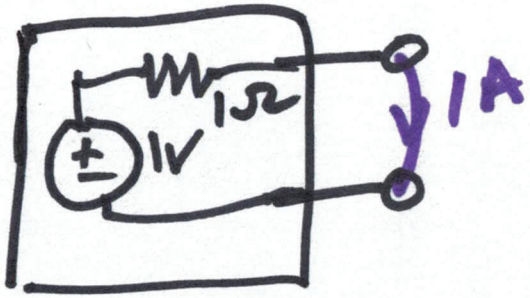


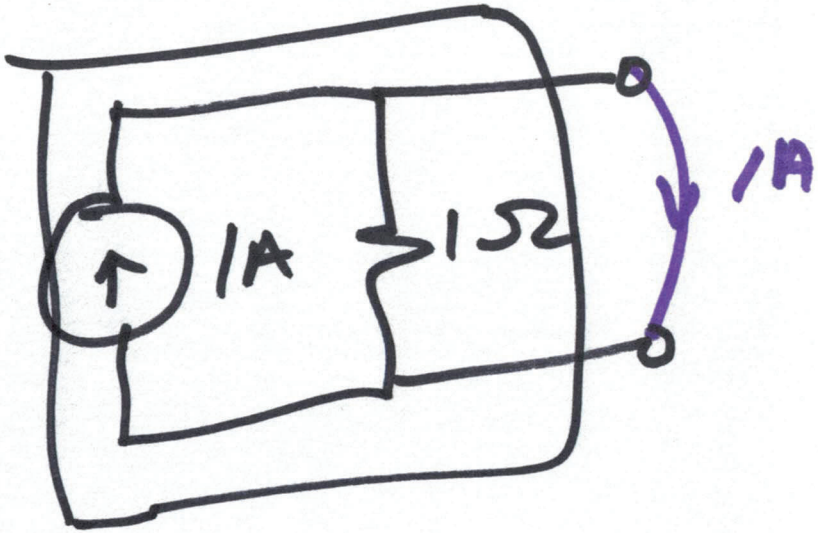
Thevinin

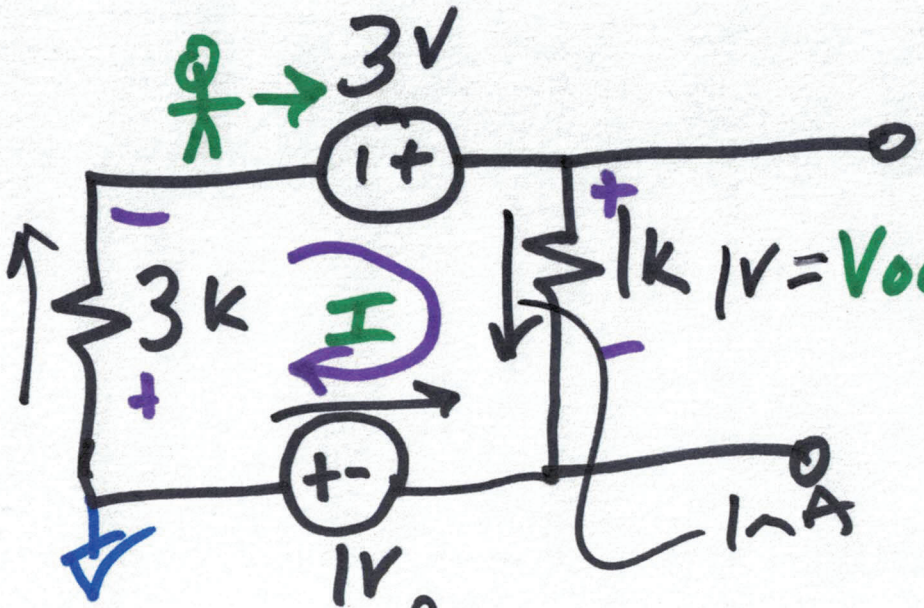


NORTON

source transformation equivalent CKT







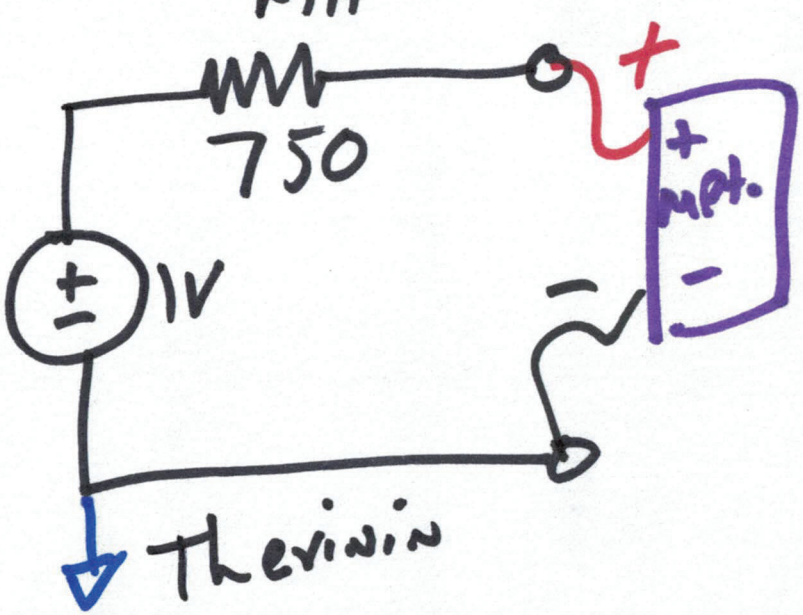
$$\frac{1k \cdot 3k}{1k + 3k} = 750$$

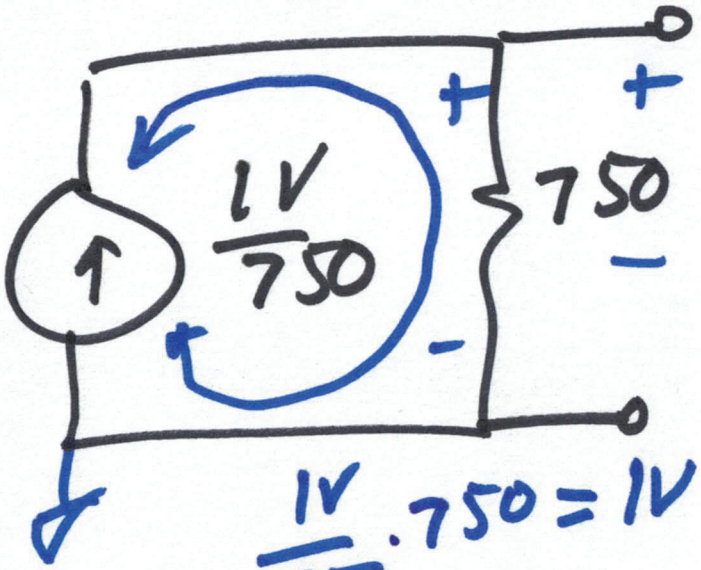
$1V = V_{OC} = V_{TH}$

$+3 - 1kI + 1 - 3kI = 0$

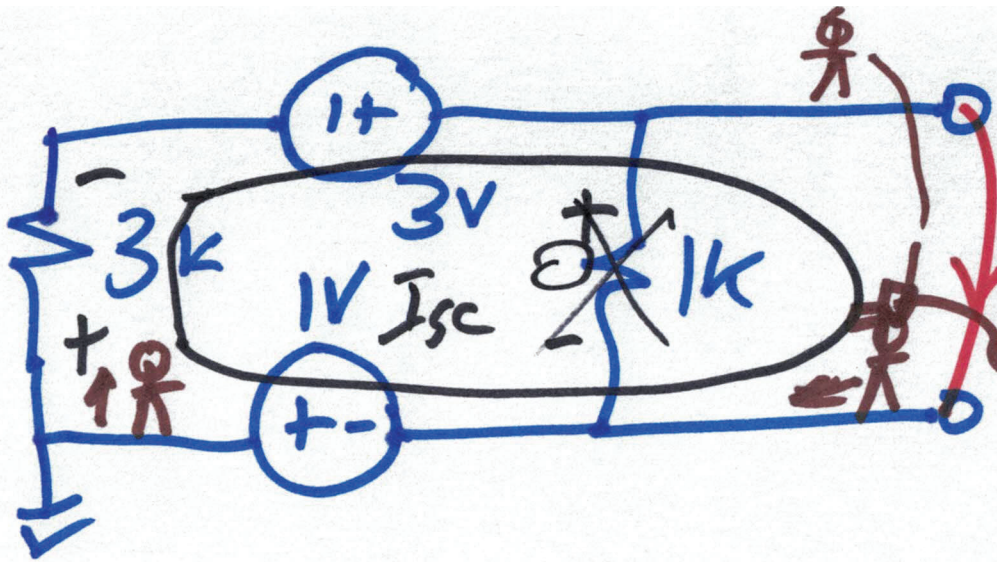
$4 = 4kI$

$I = 1mA$



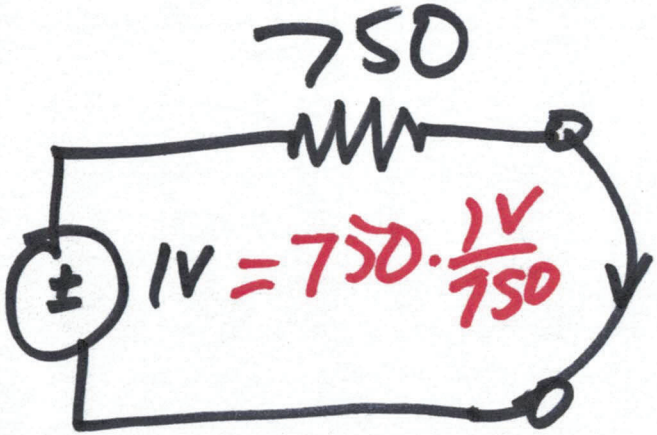


$\frac{1V}{750} \cdot 750 = 1V$

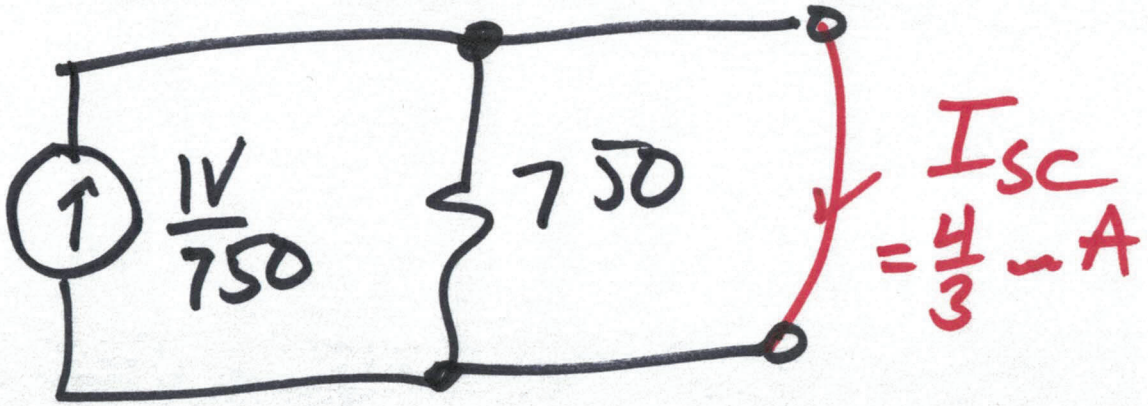


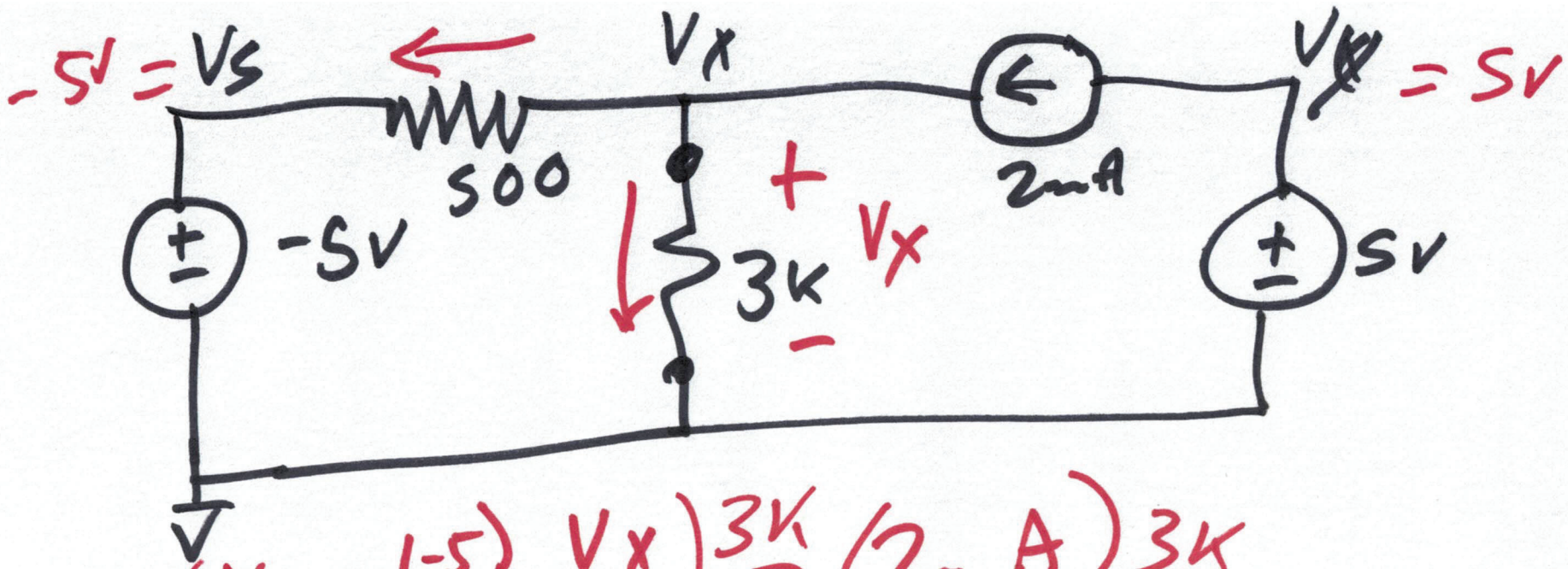
$$-3k I_{sc} + 3 + 1 = 0 \rightarrow 4 = 3k I_{sc}$$

$$I_{sc} = \frac{4}{3}\,mA$$



$$I_{sc} = \frac{1}{750} = \frac{1}{\frac{3}{4}k} = \frac{4}{3}\,mA$$

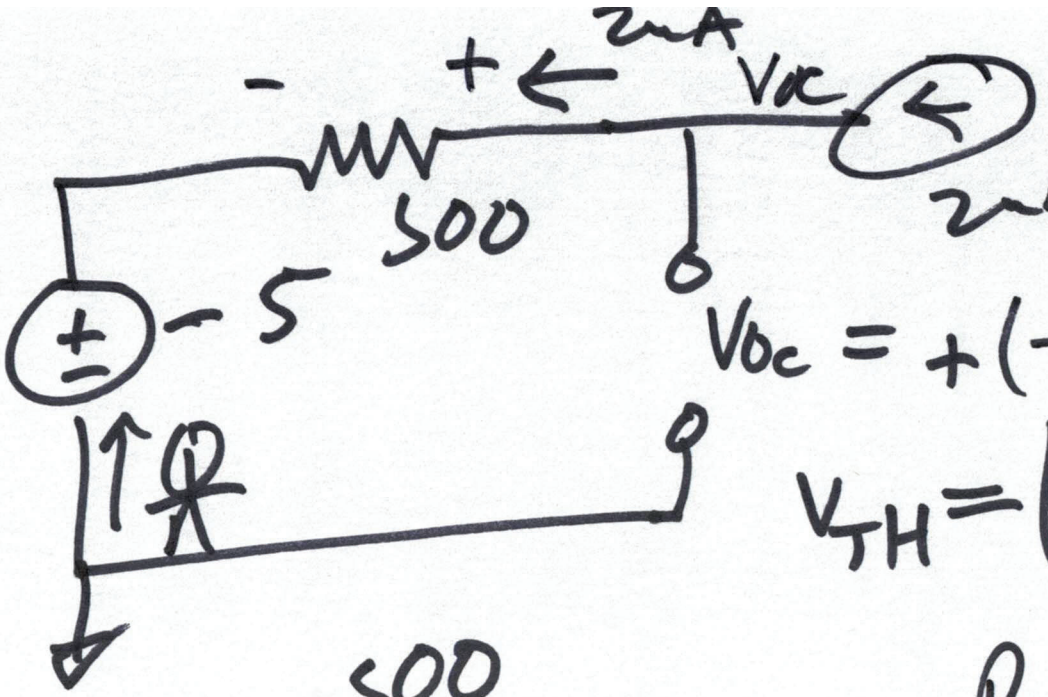




$$\left(\frac{V_x - (-5)}{500} + \frac{V_x}{3k}\right) 3k = (2\text{ A})\,3k$$

$$6V_x + 30 + V_x = 6\text{ V}$$

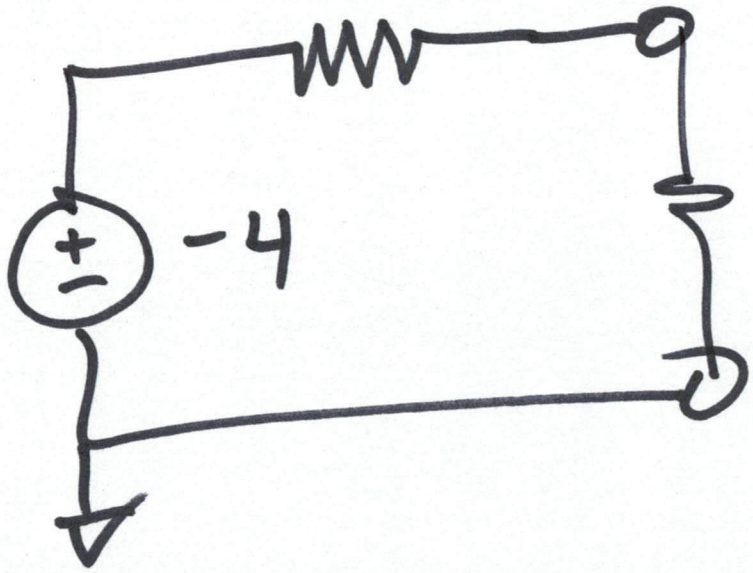
$$V_x = -\frac{24}{7}\text{ V}$$



$V_{oc} = +(-5) + 500 \cdot 2mA$

$V_{TH} = \boxed{V_{oc} = -4V}$

$R_{TH} = 500$



$3k \rightarrow -4 \cdot \frac{3k}{3k+500}$

$= \frac{-4 \cdot 6 \cdot 500}{7 \cdot 500}$

$-\frac{24}{7}V$