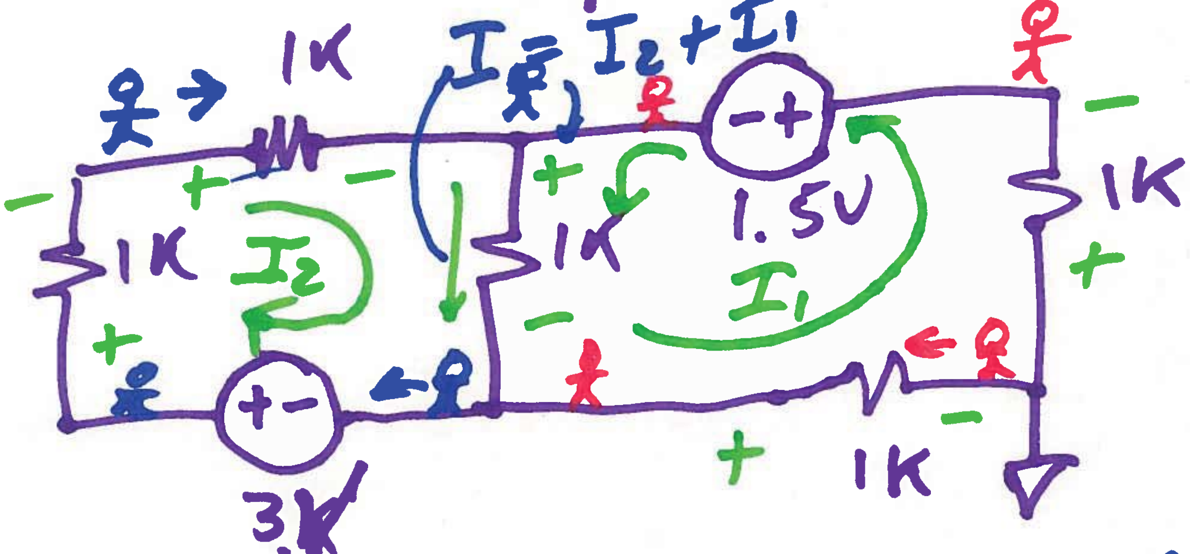
EE 220

Circuits 1

Lecture 6

Sept. 14, 2018



$3kI_1 + 1kI_2 + 1.5 = 0$

$I_1 \cdot 1K + (I_2 + I_1)1K + 1.5 + I_1 \cdot 1K = 0$

$0 = -I_2 \cdot 1K - 1K(I_2 + I_1) + 3 - 1K \cdot I_2$

$0 = -3kI_2 + 3 - 1kI_1$

$$I_1 = -3I_2 + 3\text{mA}$$

$\downarrow$

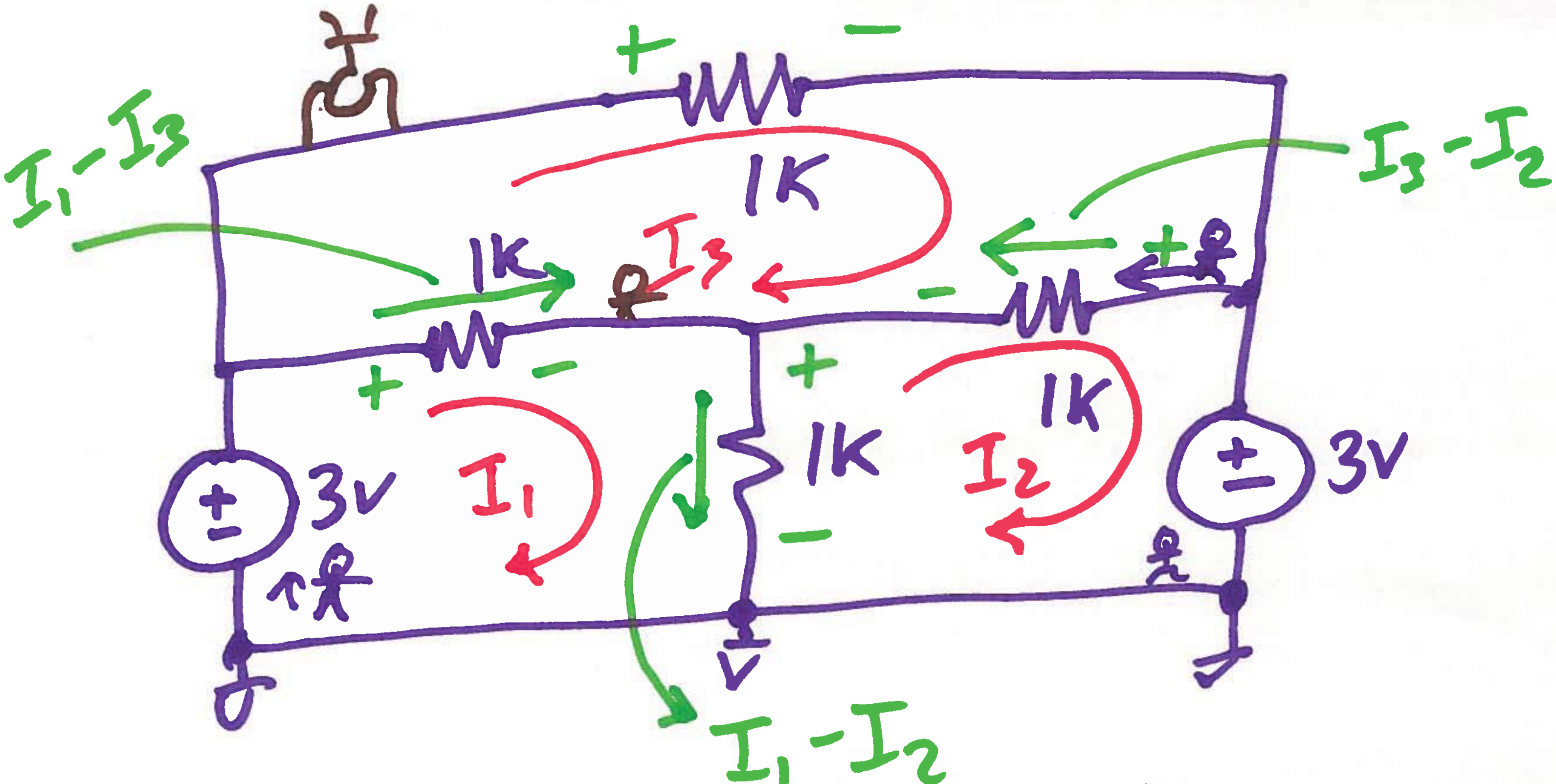
$$3kI_1 + 1kI_2 + 1.5 = 0$$

$$-9kI_2 + 9V + 1kI_2 + 1.5 = 0$$

$$-8kI_2 = -10.5$$

$$I_2 = \frac{10.5}{8k}$$

$$I_1 = \frac{-31.5}{8k} + 3\text{mA}$$



$$3 - 1K(I_1 - I_3) - 1K(I_1 - I_2) = 0$$

$$3 - 1K(I_3 - I_2) - 1K(I_1 - I_2) = 0$$

$$-1K \cdot I_3 - 1K(I_3 - I_2) + 1K(I_1 - I_3) = 0$$

$$-3I_3 + I_2 + I_1 = 0$$

$$3mA - 2I_1 + I_2 + I_3 = 0$$

$$3mA - I_1 + 2I_2 - I_3 = 0$$

$$I_1 + I_2 - 3I_3 = 0$$

$$I_1 = 3I_3 - I_2$$

$$3mA + 3I_2 - 5I_3 = 0$$

$$-(3mA + 3I_2 - 4I_3 = 0)$$

$$-I_3 = 0$$

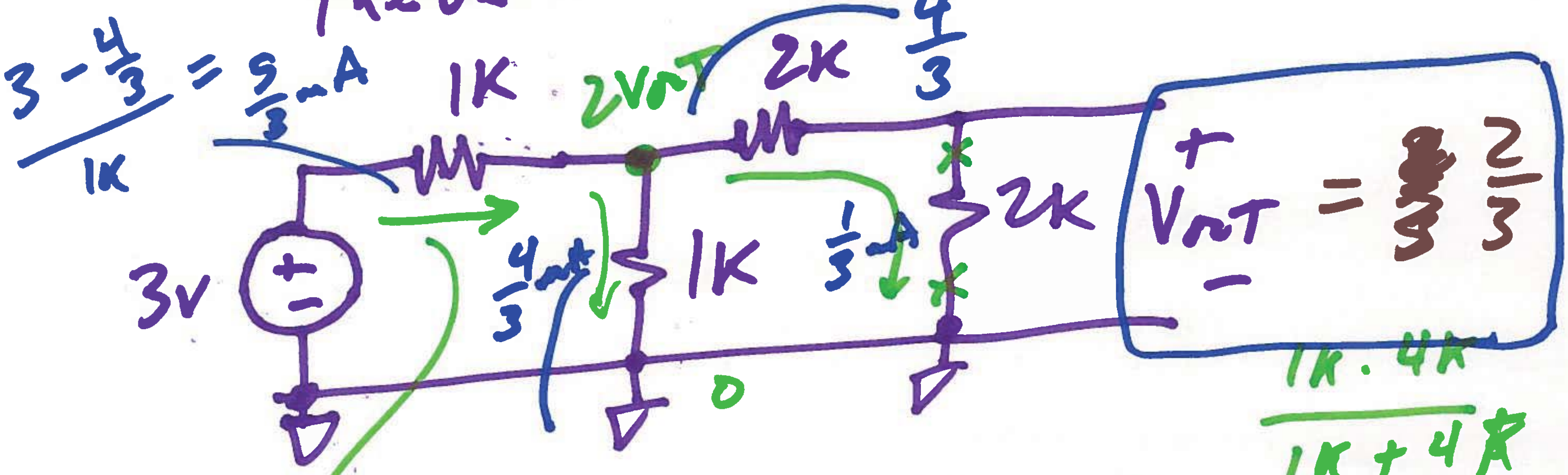
$$\boxed{I_3 = 0}$$

$$I_1 = I_2 =$$

$$3mA - I_1 - 2I_1 = 0$$

$$\boxed{I_1 = 1mA} \qquad \boxed{I_2 = -1mA}$$

Thevenin's Theorem



$$\frac{3-2V_{INT}}{1K} = \frac{2V_{INT}-0}{1K \| 4K} \qquad \frac{1K \cdot 4K}{1K+4K} = 800\Omega$$

$$3-2V_{INT} = \frac{1{,}000}{800}(2V_{INT}) \quad (1.25)$$

$$\frac{2}{3} = \frac{2\cdot 15}{3\cdot 15}$$

$$3-2V_{INT} = 2.5\,V_{INT}$$

$$3 = 4.5 \qquad \frac{3\cdot 10}{45} = \frac{30}{45}$$

$$V_{INT} = \frac{3}{4.5}$$

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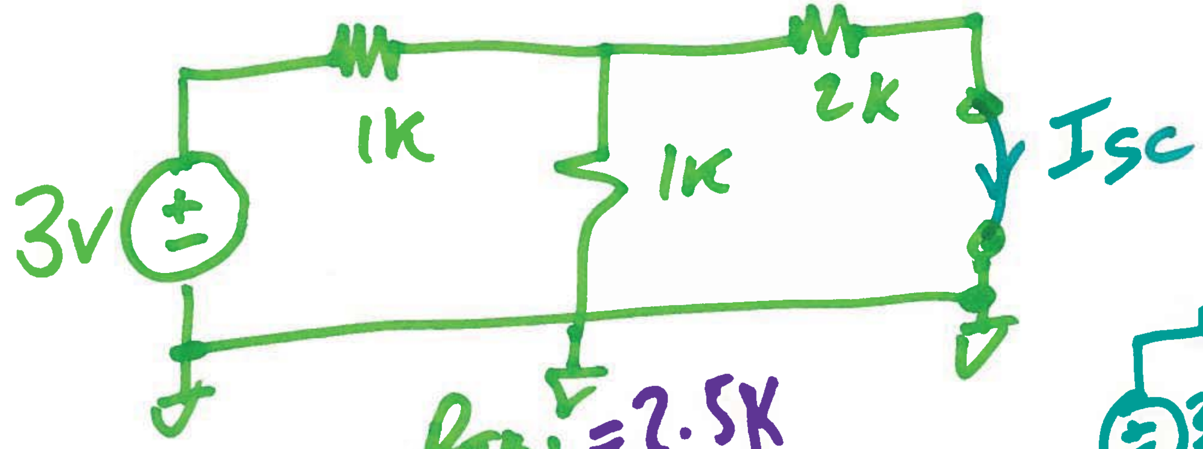
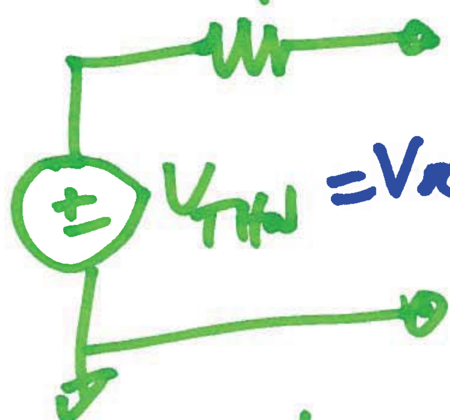


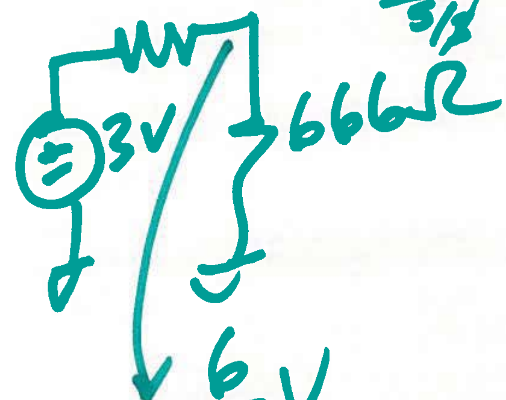
$R_{THV} = 2.5K$



$V_{THV} = V_{OC} = 1.5V$

$\frac{666}{1{,}666} \cdot 3V$

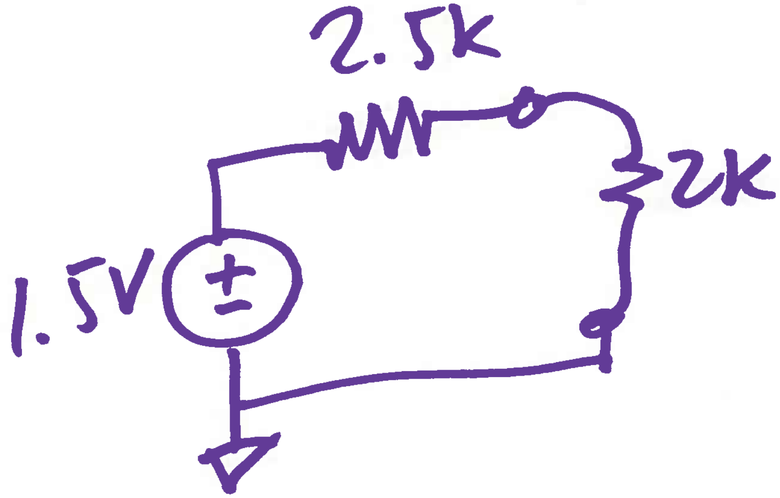
$\frac{2/3}{5/3} = \frac{2}{5}$



$\frac{6}{5}V$

Thevenin equivalent!

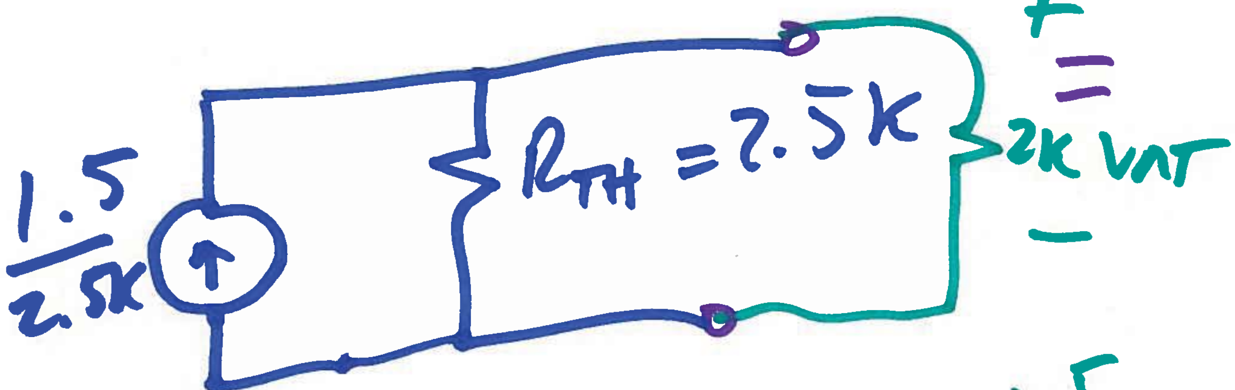
$$I_{SC} = \frac{6/5}{666} = \frac{6/5}{\frac{2}{3}k} = \frac{9}{5}mA$$



$$V_{NT} = 1.5 \cdot \frac{2k}{2k + \frac{5k}{2}}$$

$$= 1.5 \cdot \frac{4}{9} = \frac{3}{2} \cdot \frac{4}{9} = \frac{12}{18} = \frac{2}{3}\,V$$

NORTON EQUIVALENT



$$V_{NT} = \frac{1.5}{2.5k} \cdot \frac{2k \cdot 2.5k}{2k + 2.5k}$$

$$= \frac{2}{3}\,V$$