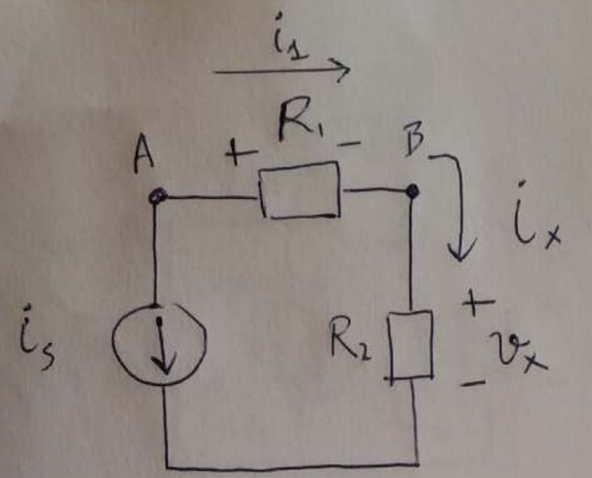
$\boxed{2.25}$



$i_s = 500\mu A$

$R_1 = 22 K\Omega$

$R_2 = 68 K\Omega$

KCL at Ⓐ : $-i_s - i_1 = 0$

at Ⓑ : $i_1 - i_x = 0$

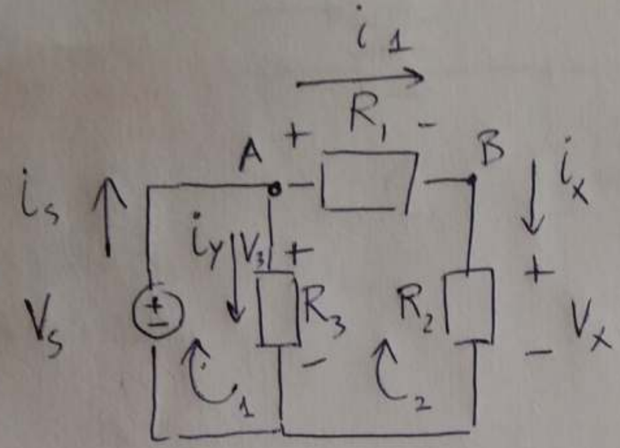
$\Rightarrow \boxed{i_x = i_1 = -i_s = -500\mu A}$

Ohm's law : $\boxed{v_x = i_x R_2} = -500\mu A . 68 K\Omega =$

$= 34000 mV$

$= \boxed{34V}$

2.27



$V_S = 18\,V$

$R_1 = 22\,K\Omega$

$R_2 = 68\,K\Omega$

$R_3 = 33\,K\Omega$

KCL at (A) : $i_s - i_y - i_1 = 0$

at (B): $i_1 - i_x = 0 \Rightarrow i_x = i_1$

$\Rightarrow i_x = i_s - i_y$

KVL at loop 1 : $-V_s + V_3 = 0 \Rightarrow V_3 = V_s = 18V$

at loop 2 :

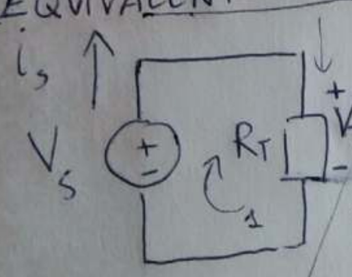
Ohm's law at R_3 : $i_y = \frac{V_3}{R_3} = \frac{18V}{33K\Omega} = \frac{6}{11}\,mA$

If we find i_s by computing an equivalent circuit,*

we can find i_x and then V_x by Ohm's law :

$$\boxed{\begin{aligned} i_x &= i_s - i_y = 0.745 - \tfrac{6}{11} = 0.2\,mA \\ V_x &= i_x R_2 = 0.2\,mA \cdot 68\,K\Omega = 13.6\,V \end{aligned}}$$

*EQUIVALENT CIRCUIT



V_T $(R_1+R_2) \parallel R_3 = \left(\frac{1}{R_1+R_2} + \frac{1}{R_3}\right)^{-1} = \frac{(R_1+R_2)R_3}{R_1+R_2+R_3} = \frac{90 \cdot 33\,K\Omega}{90+33} = 24.146\,K\Omega$

KVL: $-V_s + V_T = 0 \Rightarrow V_T = V_s = 18V$

Ohm's law : $i_s = \frac{V_T}{R_T} = \frac{18V}{24.146\,K\Omega} = 0.745\,mA$

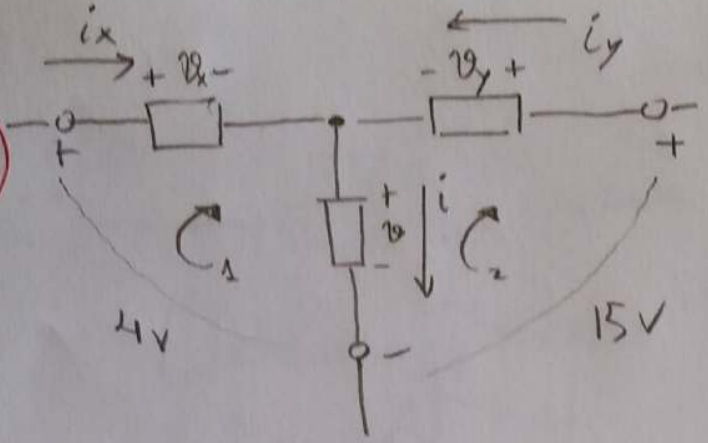
$\boxed{2.33}$

(TYPO IN THE BOOK $i_x = -0.5\,mA$)

$i_x = 0.5\,mA$

$R_x = 10\,K\Omega$

$R_y = 10\,K\Omega$



KVL at loop 1: $v_x + v - 4V = 0 \xRightarrow{\text{Ohm's law}} v = 4V - \overbrace{i_x R_x}^{5V} = \boxed{-1V}$

at loop 2: $-v - v_y + 15V = 0 \Rightarrow v_y = 15V - v = \boxed{16V}$

KCL at Ⓐ: $i_x + i_y - i = 0$

$\Downarrow$ Ohm's law

$$0.5\,mA + \frac{v_y}{R_y} - \frac{v}{R} = 0$$

$\Downarrow$

$$R = \frac{v}{0.5\,mA + \frac{v_y}{R_y}} = \frac{-1\,V}{0.5\,mA + 1.6\,mA}$$

$$= -\frac{1}{2.1}\,K\Omega = \boxed{-0.476\,K\Omega}$$

NOTE FOR READER:

Using $i_x = -0.5\,mA$

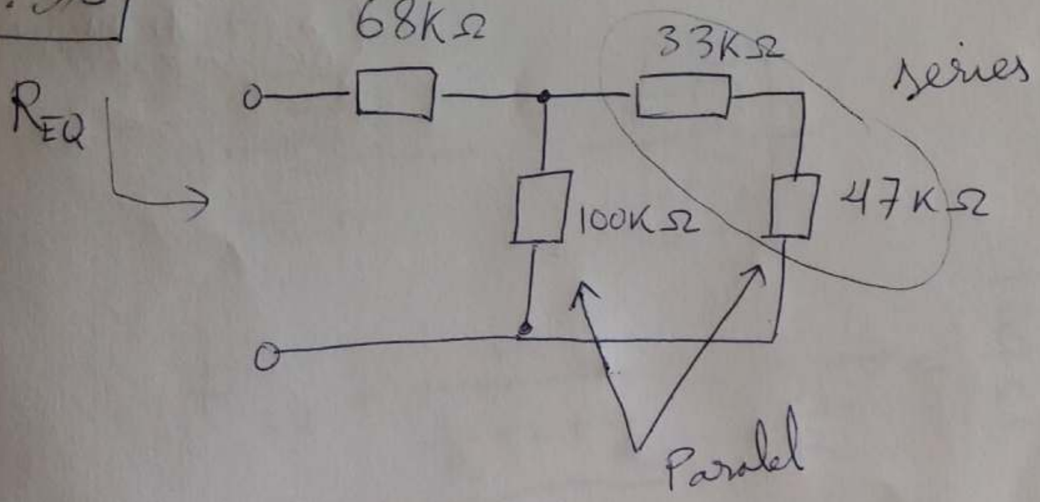
$v = 4V - v_x = 4V - i_x R_x = 9V$

$v_y = 15\,V - v = 15V - 9V = 6V$

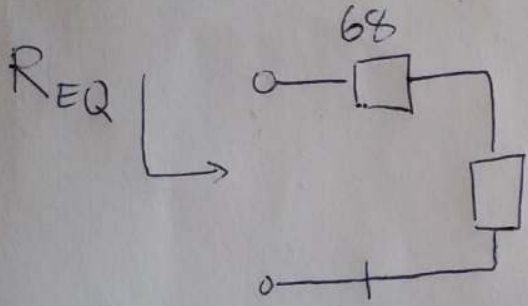
KCL at Ⓐ $-0.5\,mA + \frac{6V}{10K\Omega} - \frac{9V}{R} = 0$, $R = \frac{9}{-0.5+0.6} = \boxed{90\,k\Omega}$

Scanned by CamScanner

$\boxed{2.36}$



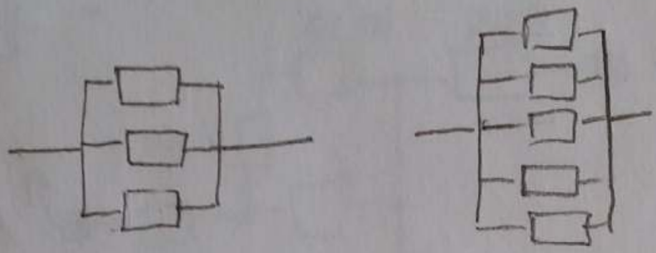
$\Updownarrow$



$$\frac{100 \cdot 80}{100+80} K\Omega \simeq 44.44 K\Omega$$

$$\boxed{R_T = 68 + 44.44 \simeq 112.44 K\Omega}$$

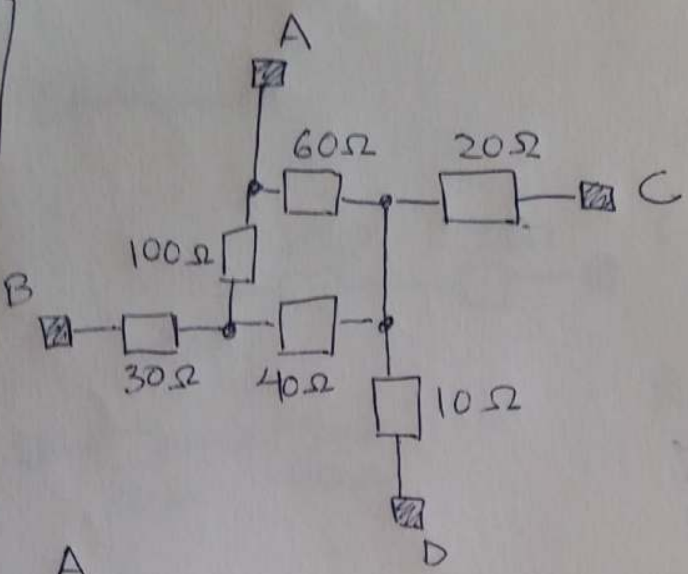
$\boxed{2.40}$



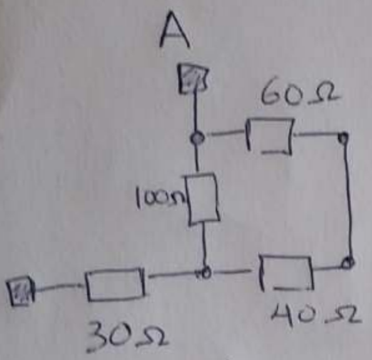
n Rs
in paralel

$$R_{EQ} = \frac{1}{\underbrace{\frac{1}{R} + \dots + \frac{1}{R}}_{n \text{ times}}} = \frac{1}{\frac{n}{R}} = \boxed{\frac{R}{n}}$$

$\boxed{2.42}$

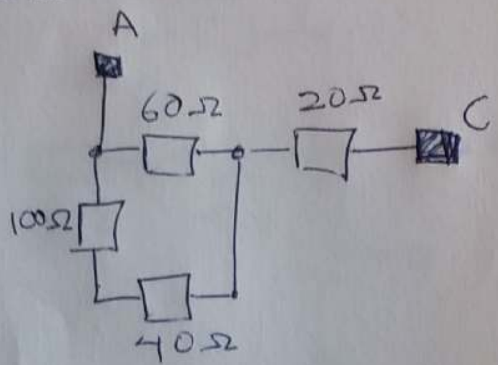


A-B



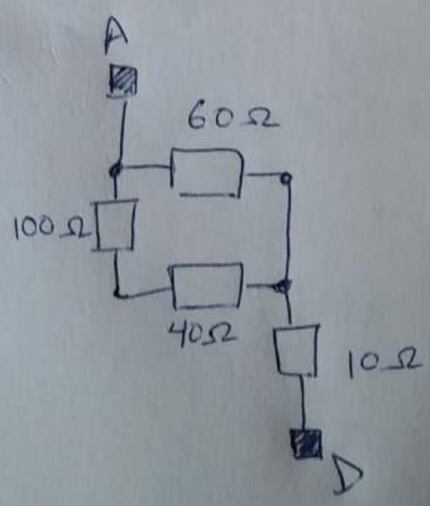
$$R_T = 30 + \left(100 \parallel (60+40)\right)$$
$$= 30 + 50 = \boxed{80\,\Omega}$$

A-C



$$R_T = 20 + \left(60 \parallel (100+40)\right)$$
$$= 20 + \frac{60 \cdot 140}{140+60}$$
$$= 20 + \frac{84\cancel{00}}{2\cancel{00}} = 20 + 42$$
$$= \boxed{62\,\Omega}$$

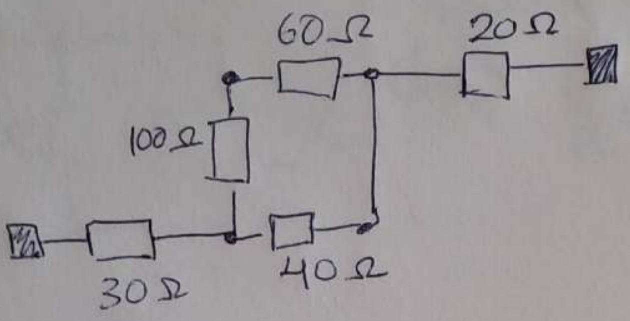
A-D



$$R_T = 10 + \left(\overbrace{60 \parallel (100+40)}^{\text{from above}}\right)$$
$$= 10 + 42$$
$$= \boxed{52\,\Omega}$$

2.42 continued

B-C



$$R_T = 30 + ((100+60) \parallel 40) + 20$$

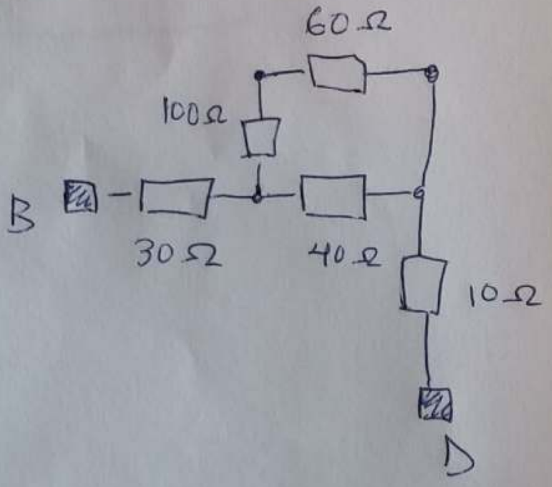
$$= 50 + \frac{160 \cdot 40}{160+40}$$

$$= 50 + \frac{6400}{200} =$$

$$= 50 + 32$$

$$= \boxed{82\,\Omega}$$

B-D

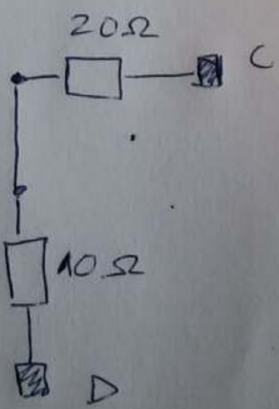


$$R_T = 30 + \left(\underbrace{(100+60) \parallel 40}\right) + 10$$

$$= 30 + 32 + 10$$

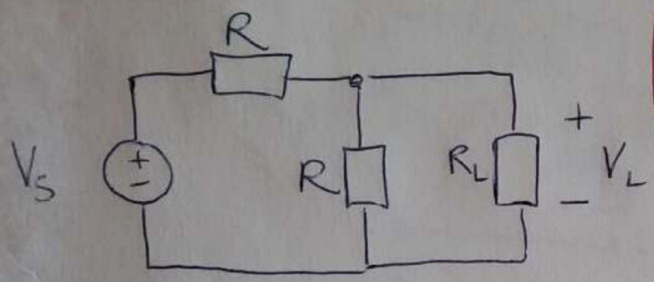
$$= \boxed{72\,\Omega}$$

C-D



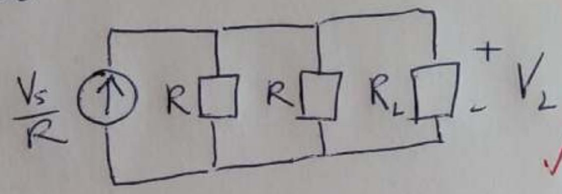
$$R_T = 20 + 10 = \boxed{30\,\Omega}$$

2.55



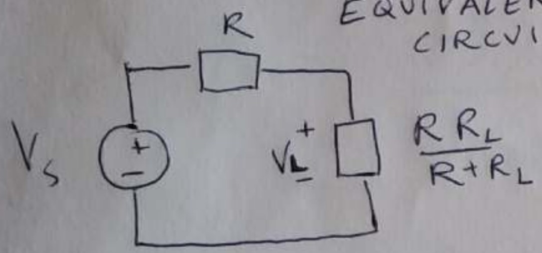
alternative path

(USING EQUIVALENT SOURCE $\Longleftrightarrow$



)

$\Updownarrow$ EQUIVALENT CIRCUIT



Voltage division:

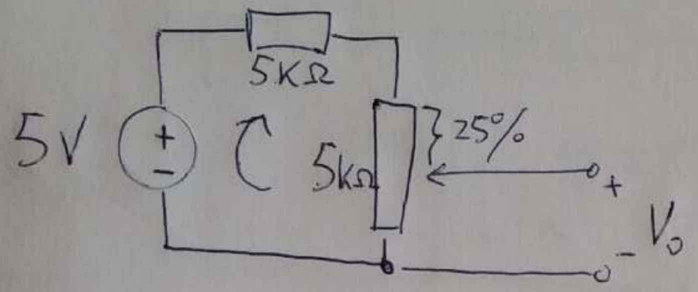
$$V_L = \frac{\frac{RR_L}{R+R_L}}{\left(\frac{RR_L}{R+R_L}+R\right)} V_s$$

$$= \frac{RR_L}{RR_L + R(R+R_L)} V_s$$

$$= \frac{RR_L}{2RR_L + R^2} V_s =$$

$$\boxed{= \frac{1}{2+\frac{R}{R_L}} V_s}$$

$\boxed{2.59}$

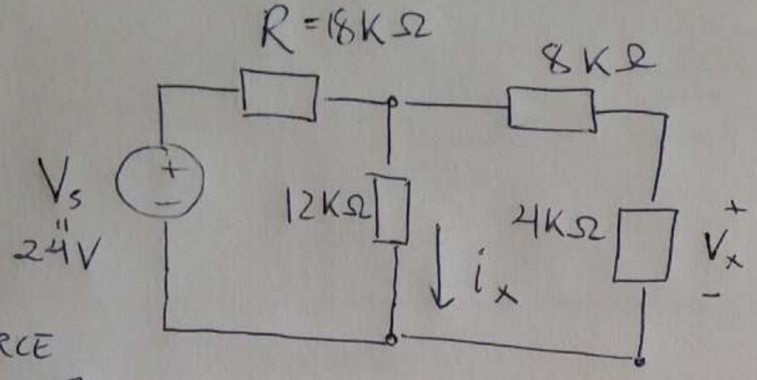


By voltage division

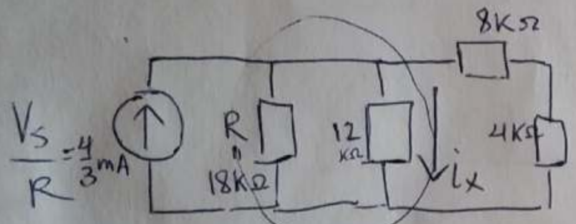
$$V_o = \frac{75\%\ 5\cancel{K\Omega}}{5\cancel{K\Omega} + 5\cancel{K\Omega}}(5V) = \frac{3}{8}(5V) = \boxed{0.375 \frac{\cancel{K\Omega}}{\cancel{K\Omega}}} \times 5\,V$$

$$= \boxed{1.875\,V}$$

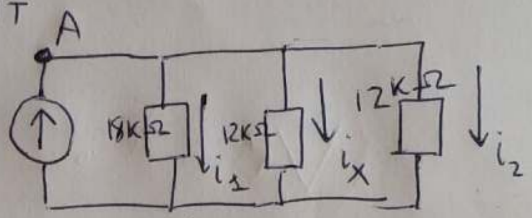
2.72



EQ. SOURCE



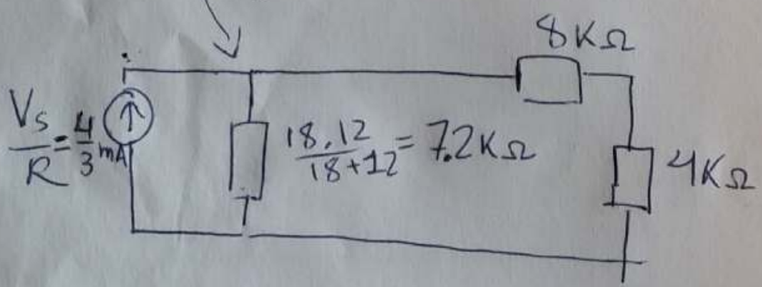
EQ. CIRCUIT



~~KCL at A:~~

$$\cancel{\frac{4}{3}\,\text{mA} = i_1 + i_x + i_2}$$

EQ. CIRCUIT



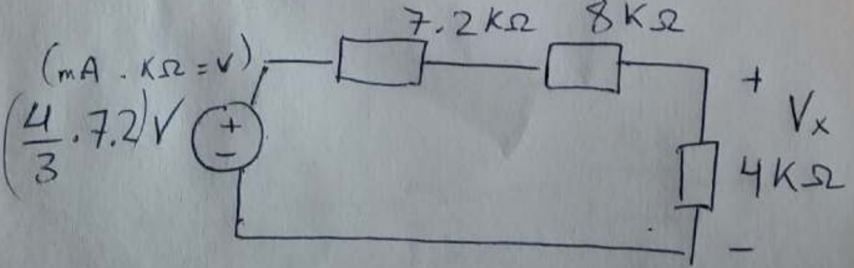
Current division

$$i_x = \frac{\frac{1}{12}}{\frac{1}{18} + \frac{1}{12} + \frac{1}{12}} \, \frac{4}{3}\,\text{mA}$$

$$= \frac{1}{\frac{2}{3} + 2} \, \frac{4}{3}\,\text{mA}$$

$$= \frac{4}{2+6} = \boxed{0.5\,\text{mA}}$$

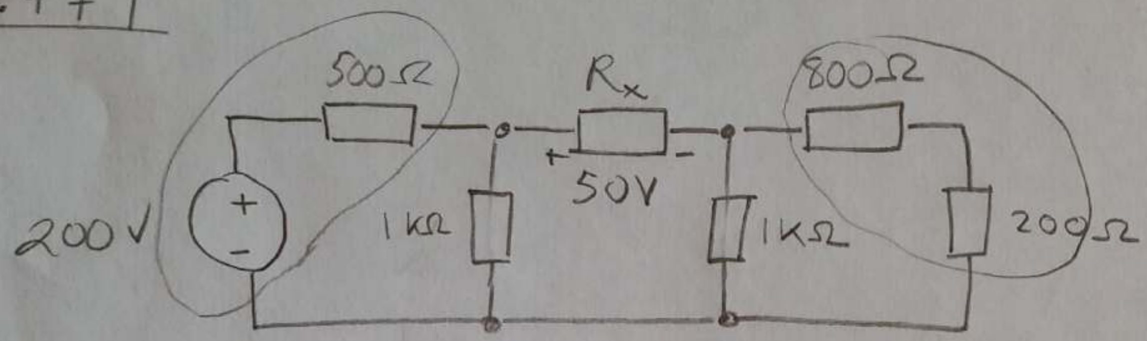
EQ. SOURCE



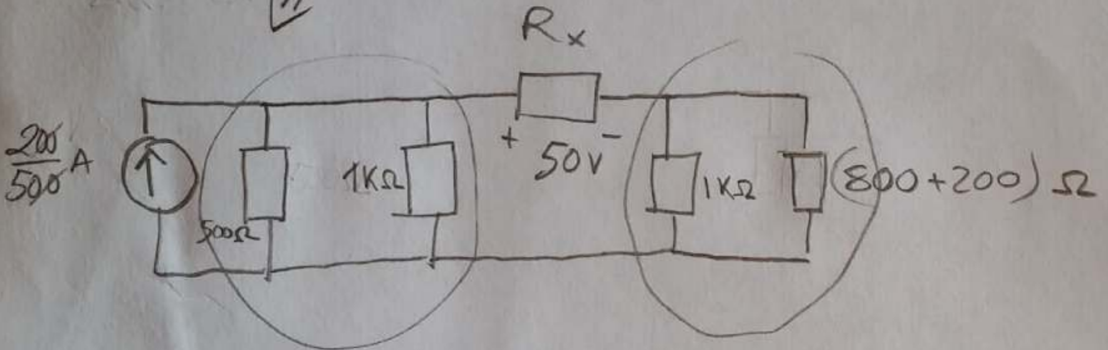
Voltage division:

$$V_x = \frac{4\,\cancel{K\Omega}}{\underbrace{(4 + 7.2 + 8)}_{K\Omega}} \left(\frac{4}{3} \cdot 7.2\right) = \boxed{2\,V}$$

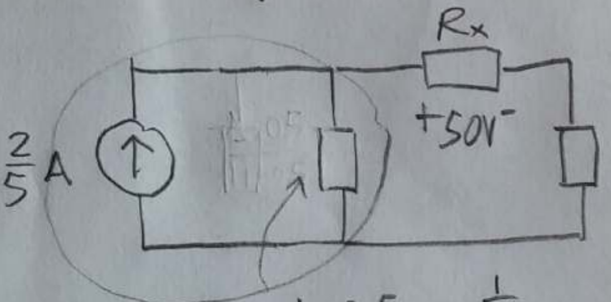
2.77



EQ. SOURCE & EQ. RESISTANCE



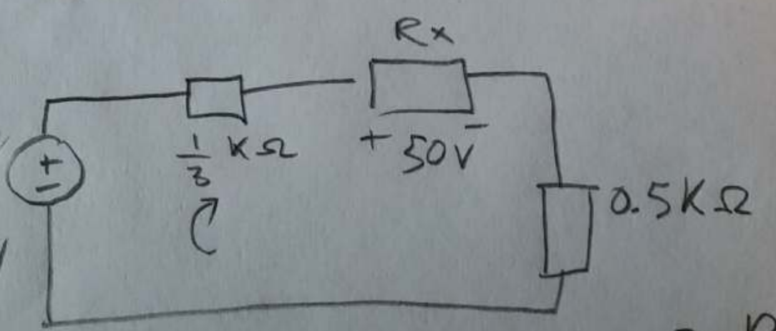
EQ. CIRCUIT



$$\frac{1\cdot 1}{1+1} = 0.5\ \mathrm{K\Omega}$$

$$\frac{1\cdot 0.5}{1+0.5} = \frac{\frac{1}{\cancel{2}}}{\frac{3}{\cancel{2}}} = \frac{1}{3}\ \mathrm{K\Omega}$$

EQ. SOURCE



$$\frac{2}{5}\cdot\frac{1}{3}\ \mathrm{kV} = \frac{2}{15}\ \mathrm{kV}$$

Voltage division

$$5\cancel{0}\cancel{V} = \frac{R_x}{\frac{1}{3}+R_x+0.5}\,\frac{200\cancel{0}}{15}\cancel{V};$$

$$\frac{200}{15}R_x = 5\left(\frac{1}{3}+R_x+0.5\right);$$

$$R_x = \frac{5\left(\frac{1}{3}+\frac{1}{2}\right)}{\frac{200}{15}-5} = \boxed{0.5\ \mathrm{K\Omega}}$$