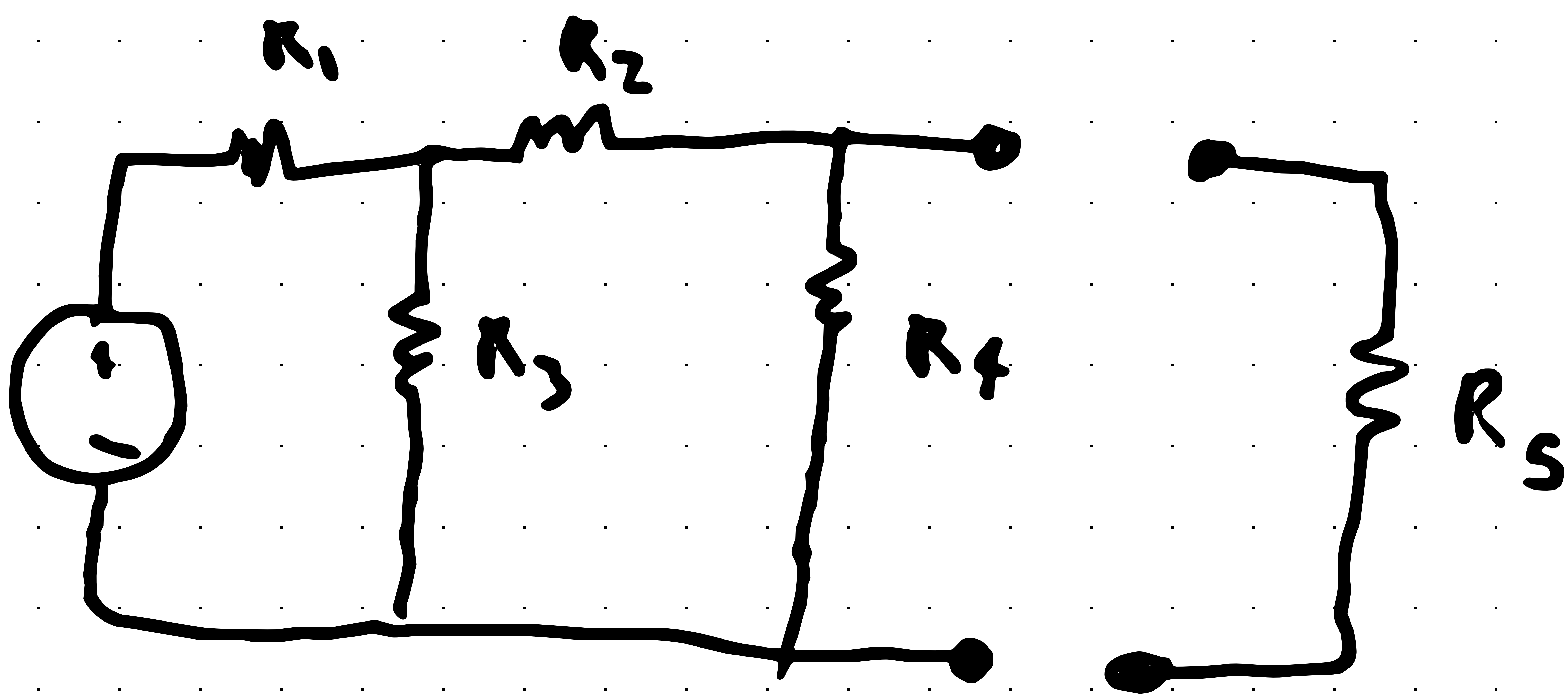
Open Circuit (O.C)



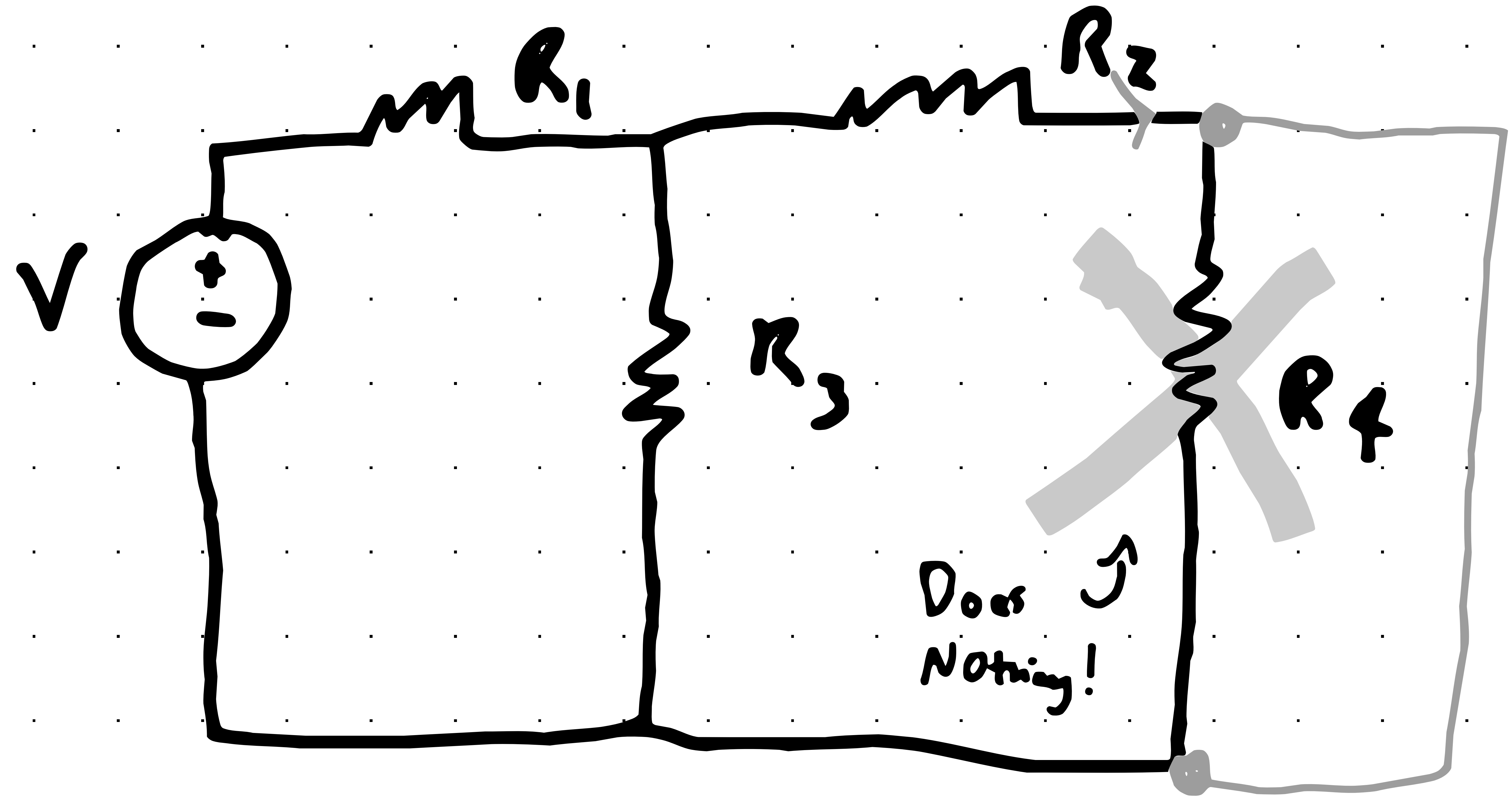
For an open circuit:

$I = 0$

But there is voltage!

Would you stick your finger in an outlet?

Short Circuit (S.C)



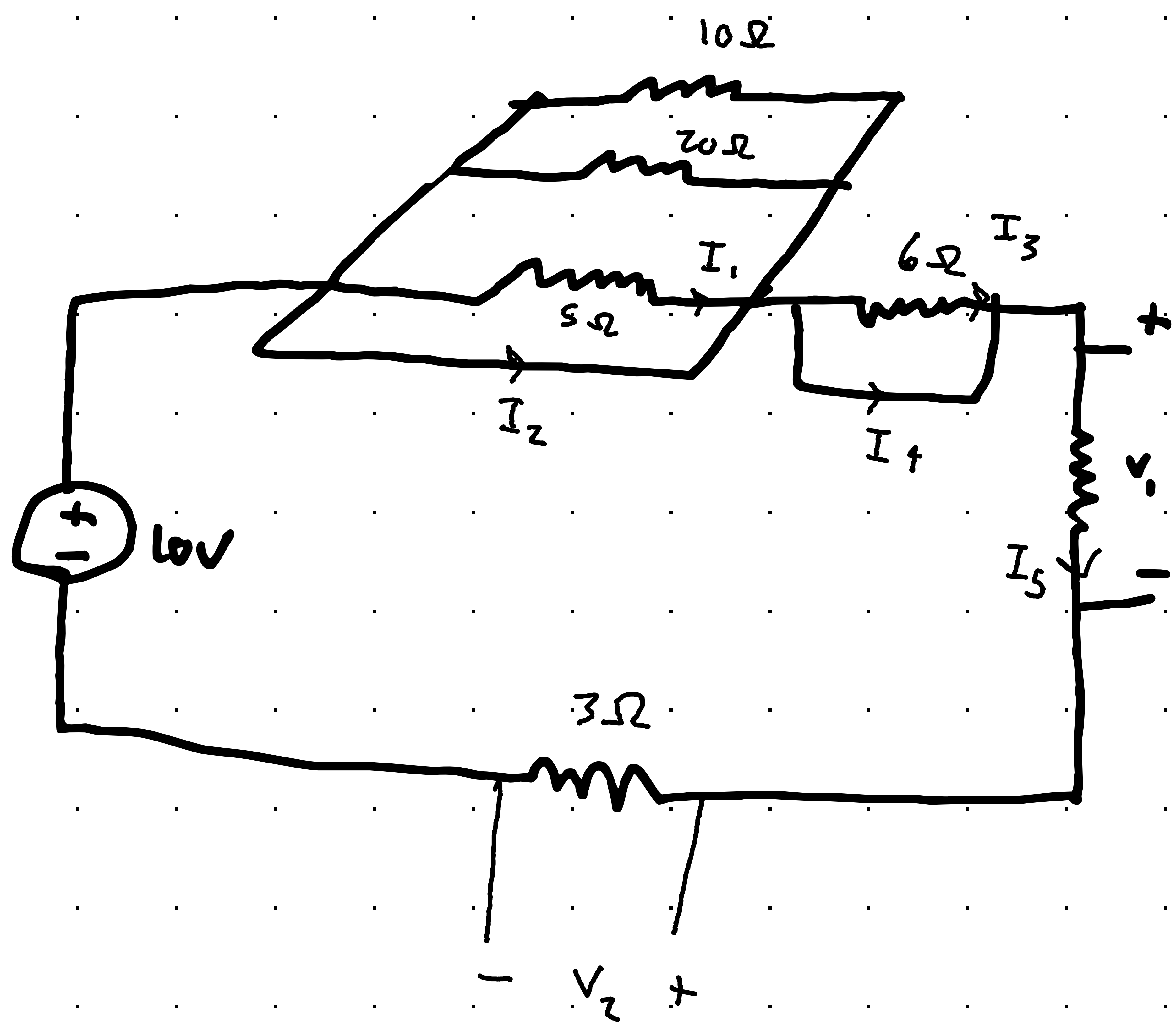
Why would i go through a resistor when it doesn't have to?

Currents prefer lower resistance values.

There is a current in the short circuit branch, but the voltage is equal to **zero**.

$V = I(0)$

Example 1

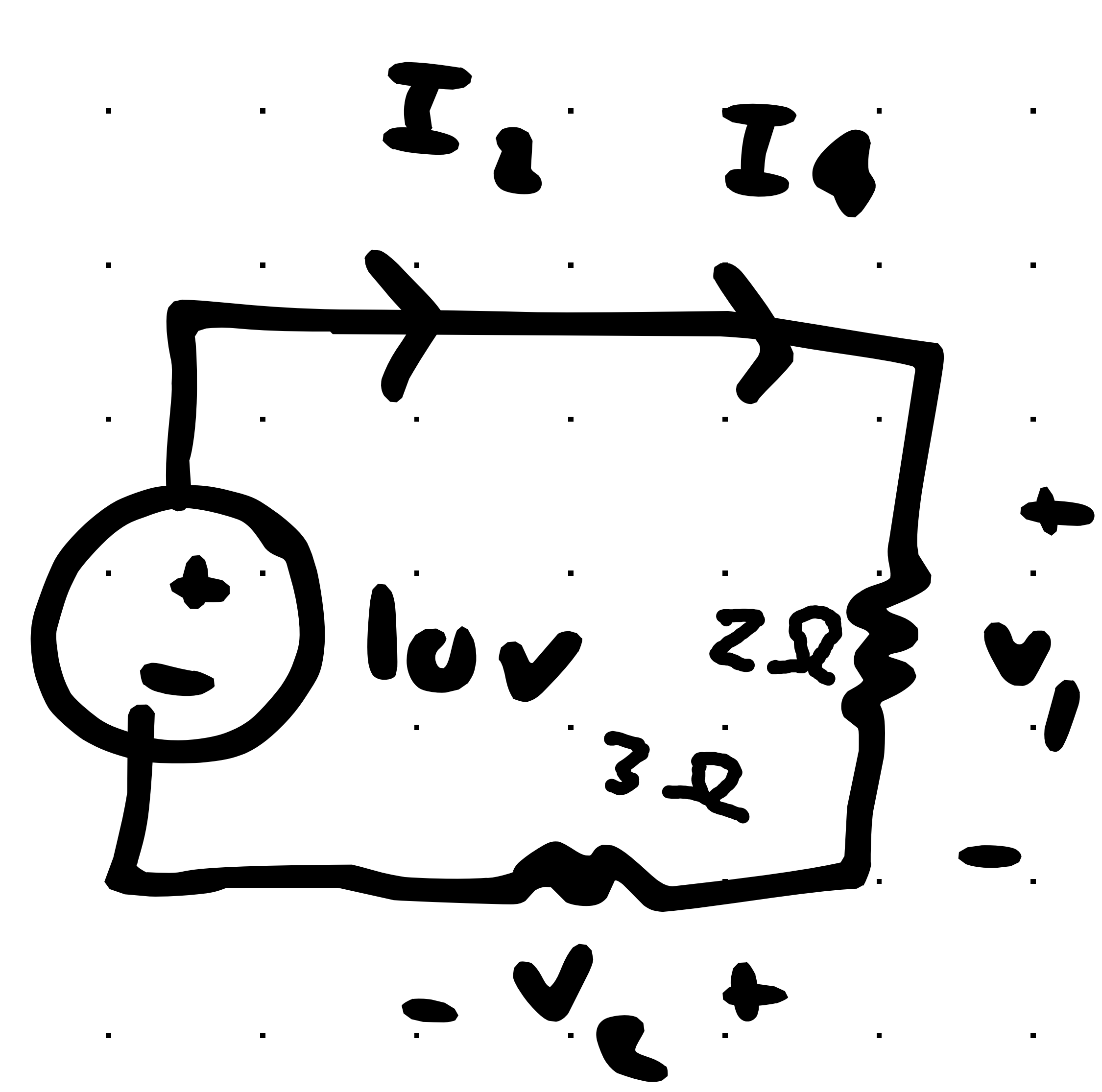


Sol.

$I_3 = 0$ Because of S.C

$I_1 = 0$ Because of S.C

$I_2 = I_4 = \frac{10}{5} = \underline{2A}$



$V_1 = IR$

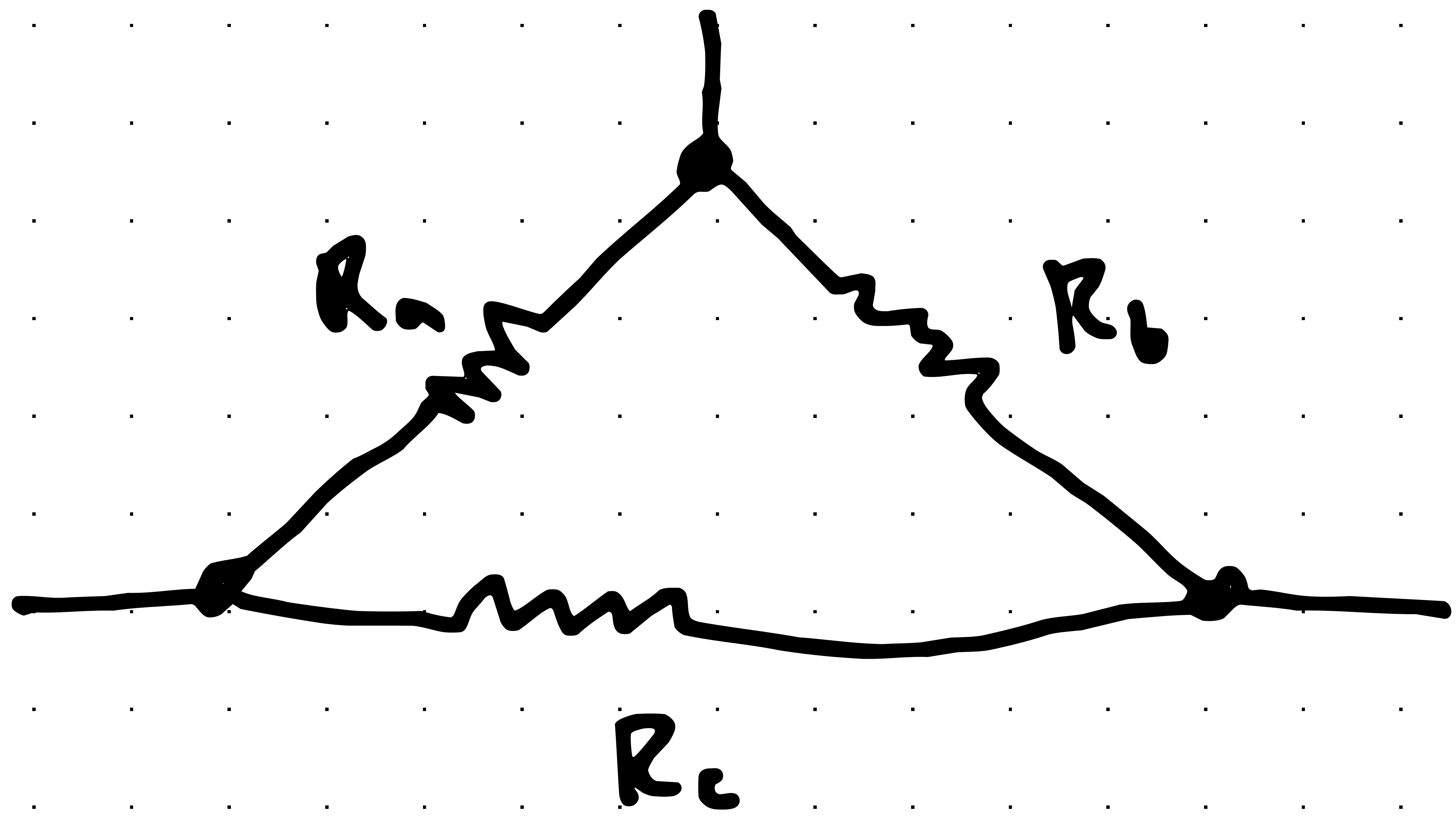
$(2)(2) = \underline{4V}$

$V_2 = (2)(3) = \underline{6V}$

$R_{total} = 3\Omega + 2\Omega$

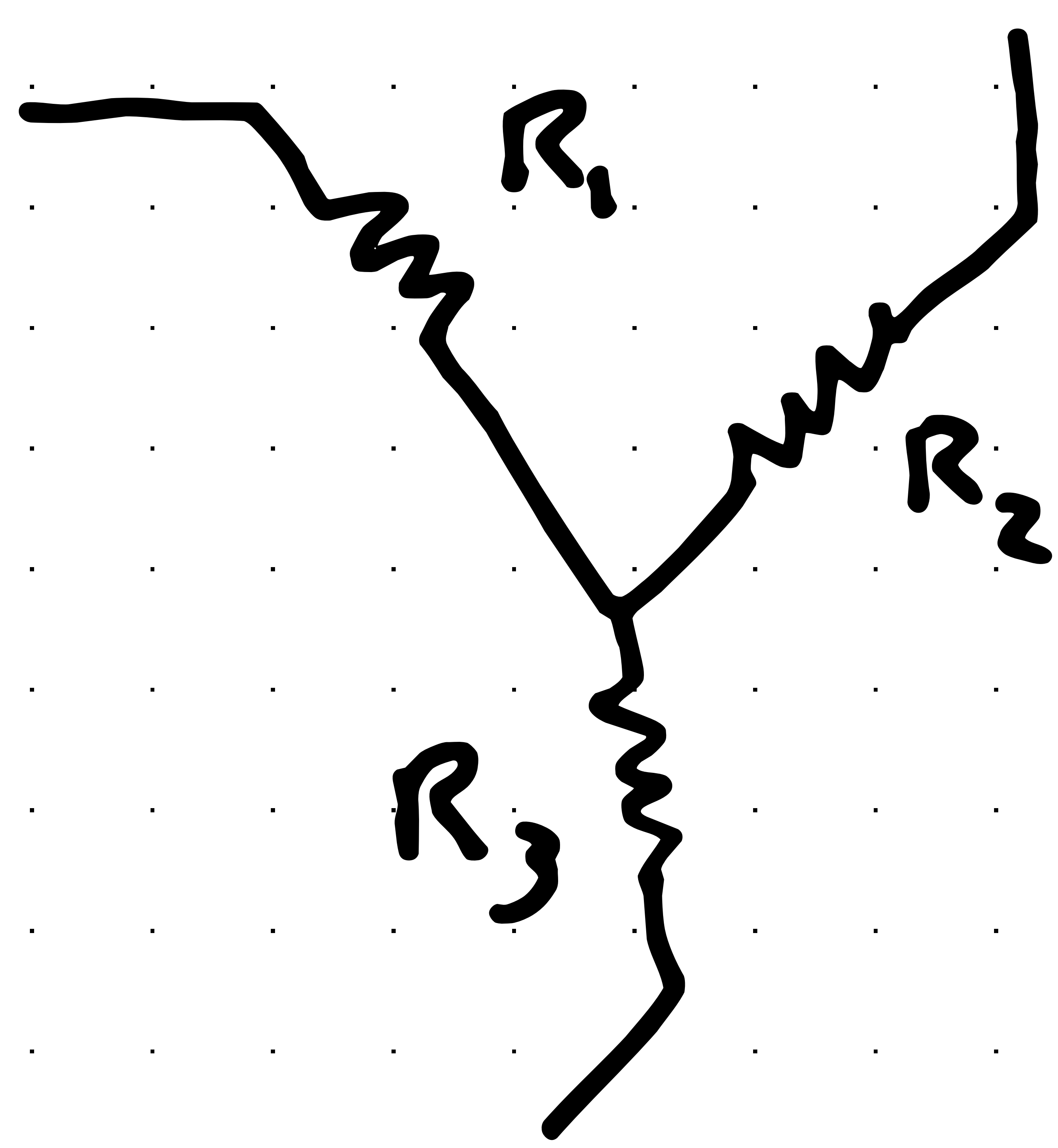
$= 5\Omega$

Delta Connections

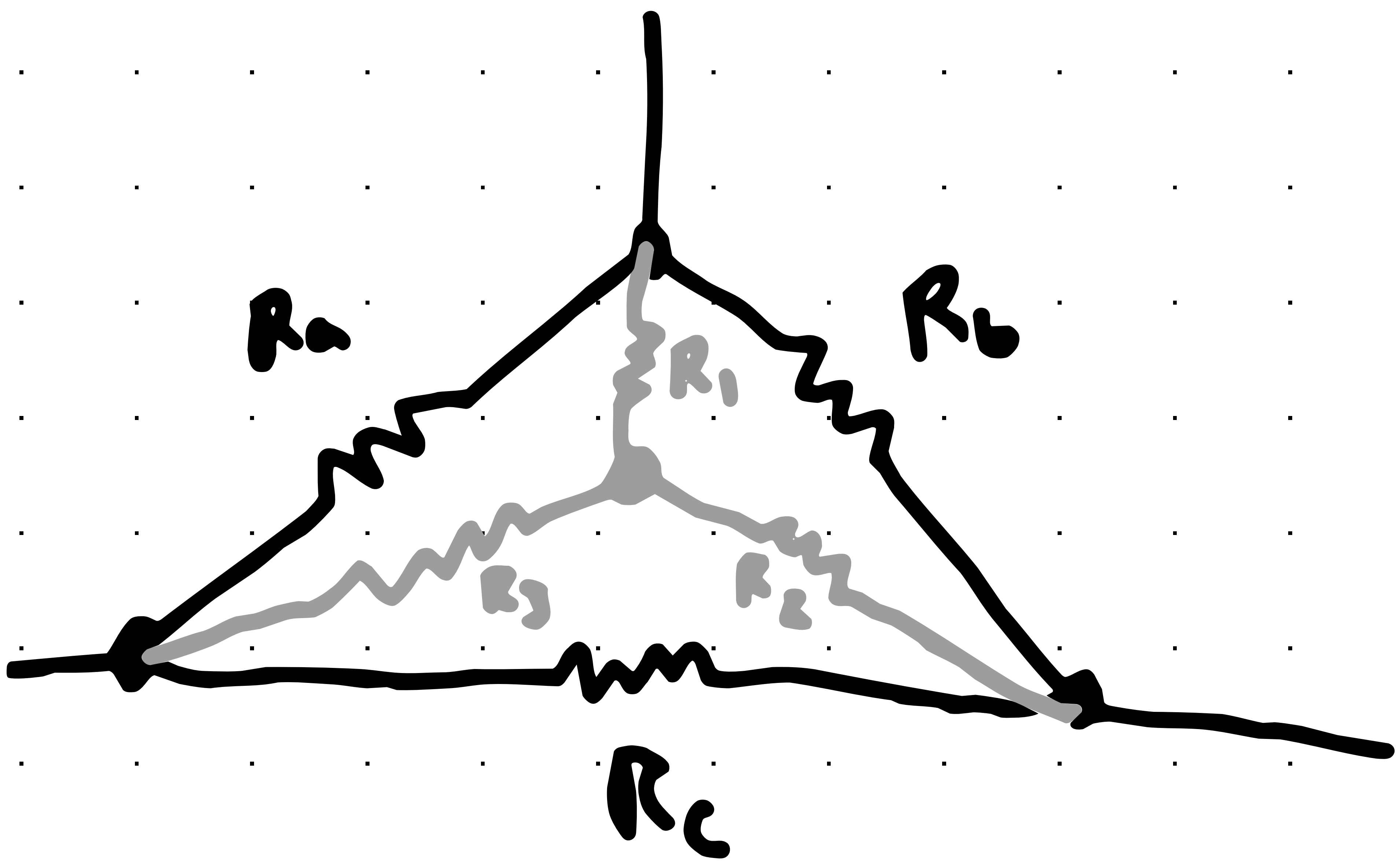


Three Branches, connected by three nodes, in a Closed loop.

Wye (Star) Connection



Conversion from Delta to Wye Connection



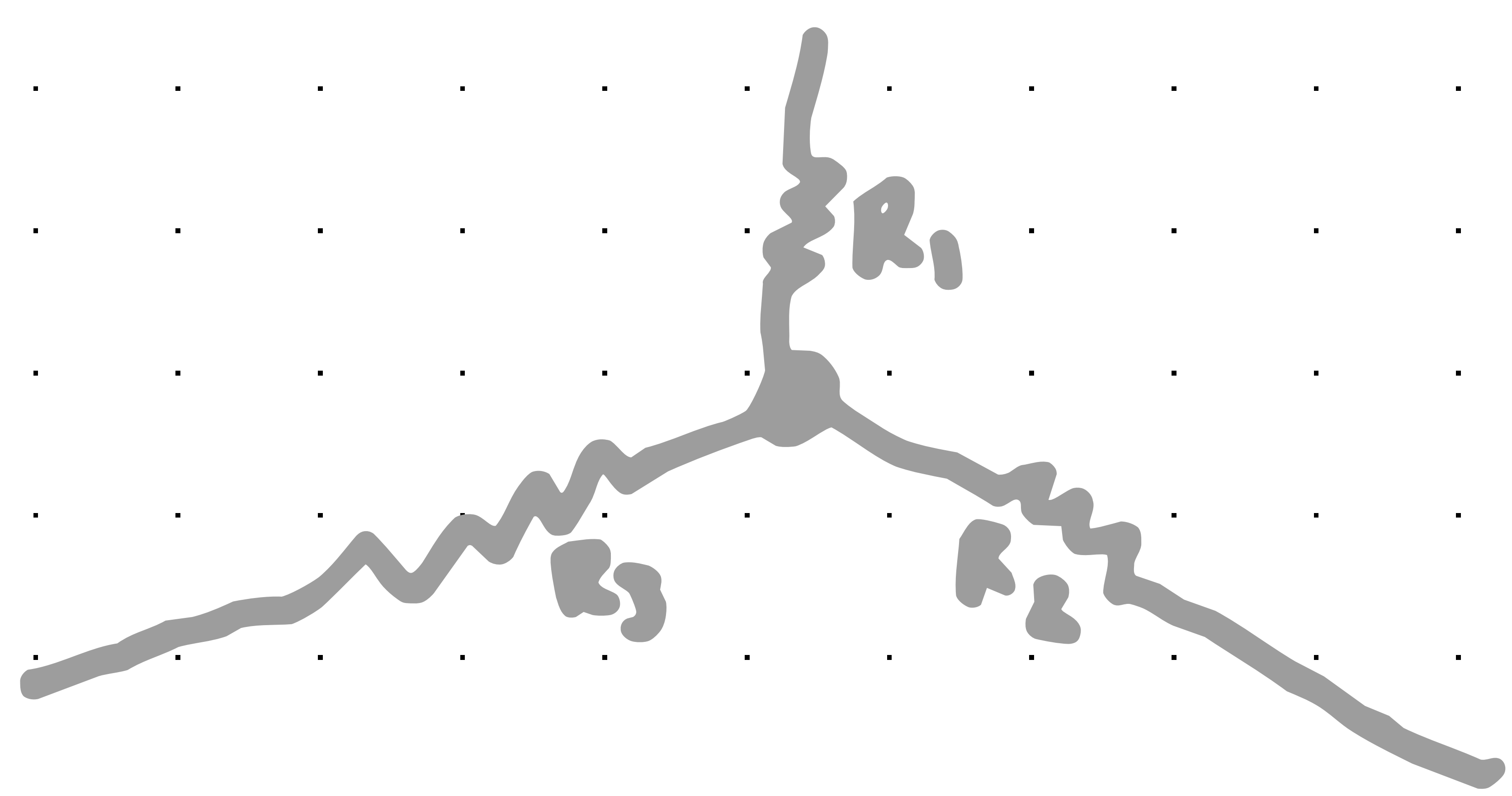
1) From each node, draw a resistor.

$$R_1 = \frac{R_a R_b}{R_a + R_b + R_c}$$

$$R_1 = \frac{R_a R_b}{R_a + R_b + R_c}$$

$$R_2 = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_c}{R_a + R_b + R_c}$$

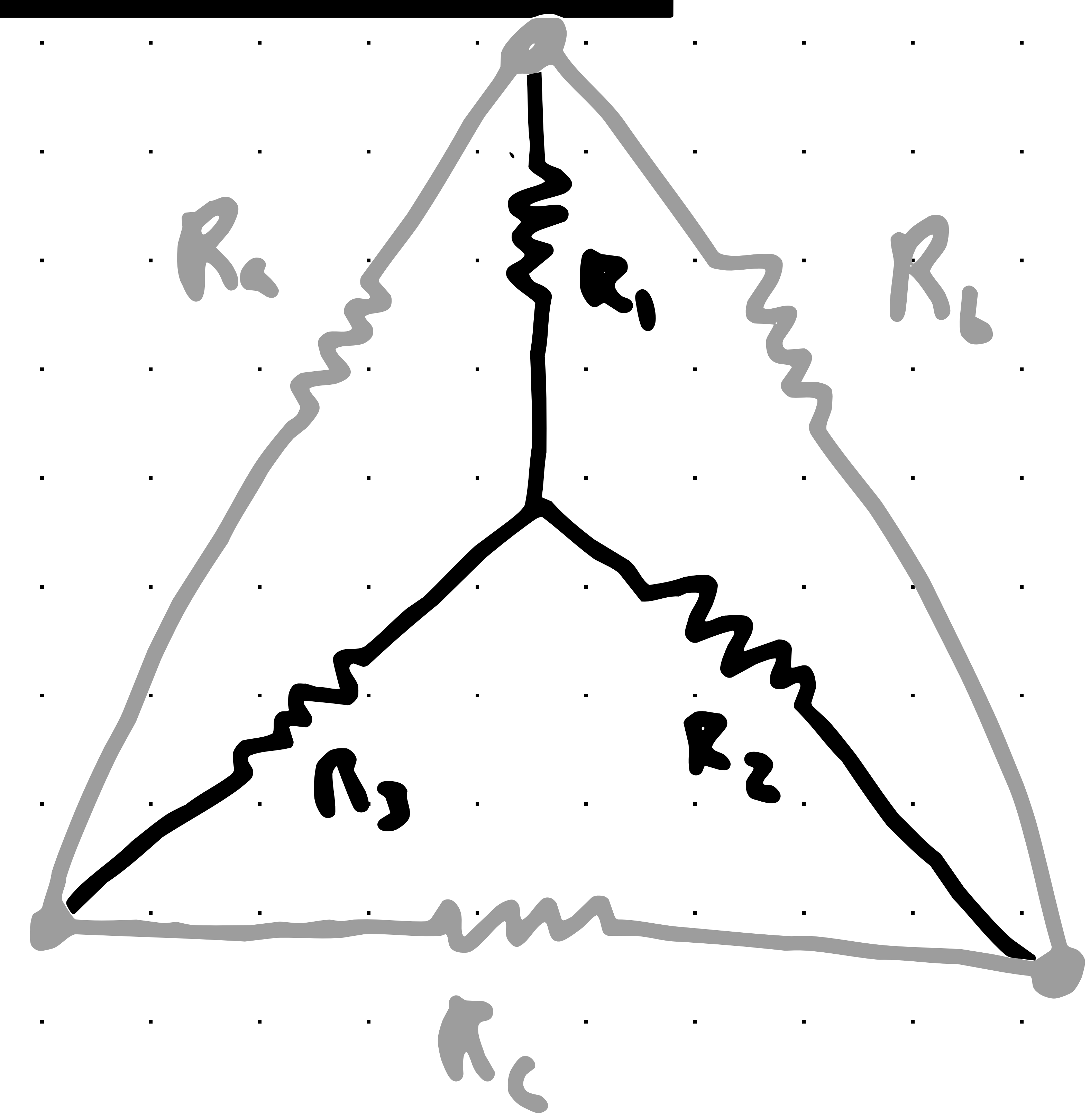


Conversion from Wye to Delta Connection

$$R_a = R_1 + R_3 + \frac{R_1 R_3}{R_2}$$

$$R_b = R_1 + R_2 + \frac{R_1 R_2}{R_3}$$

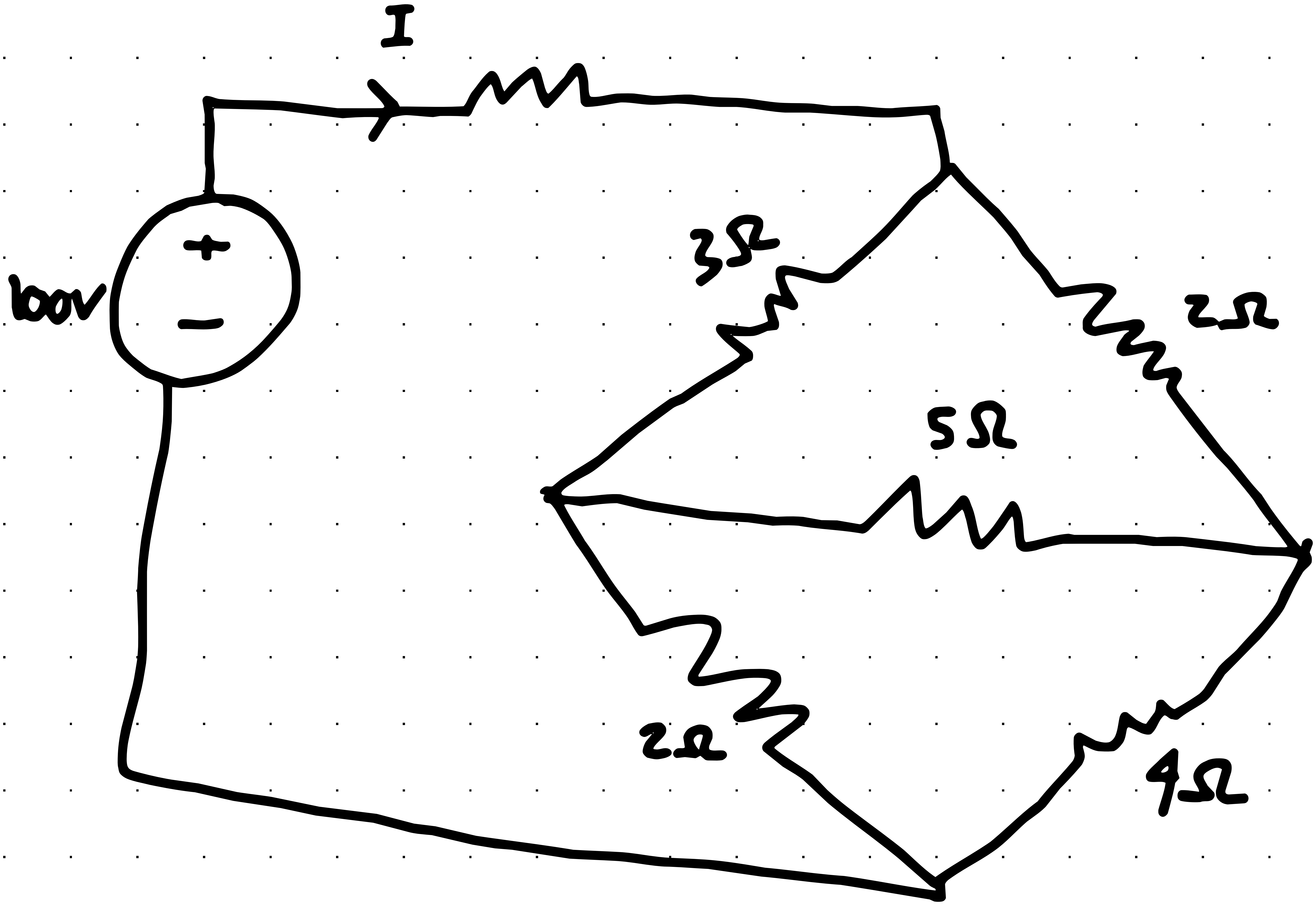
$$R_c = R_2 + R_3 + \frac{R_2 R_3}{R_1}$$



$$R_a = R_1 + R_3 + \frac{R_1 R_3}{R_2}$$

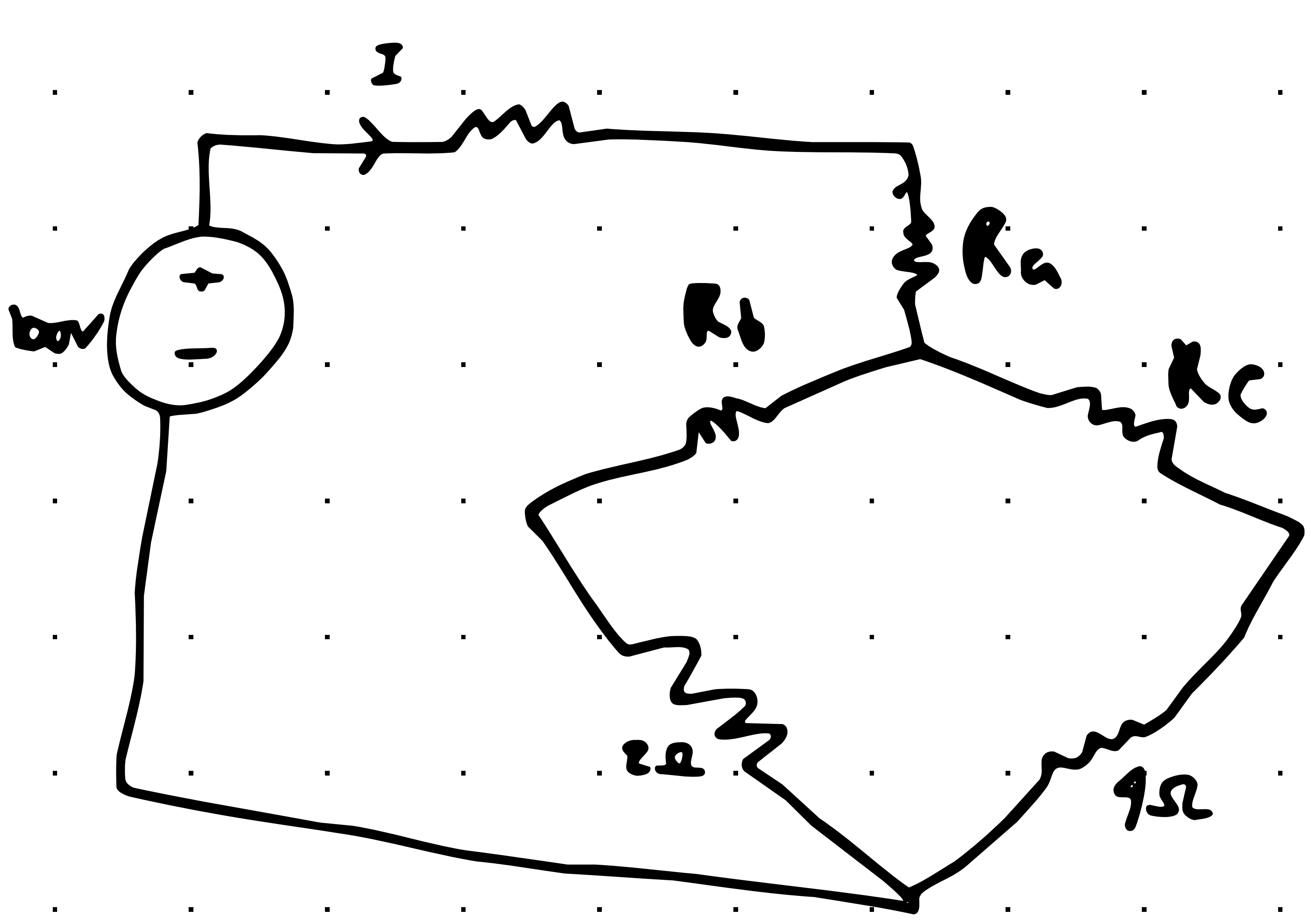
Example 2

Calculate I

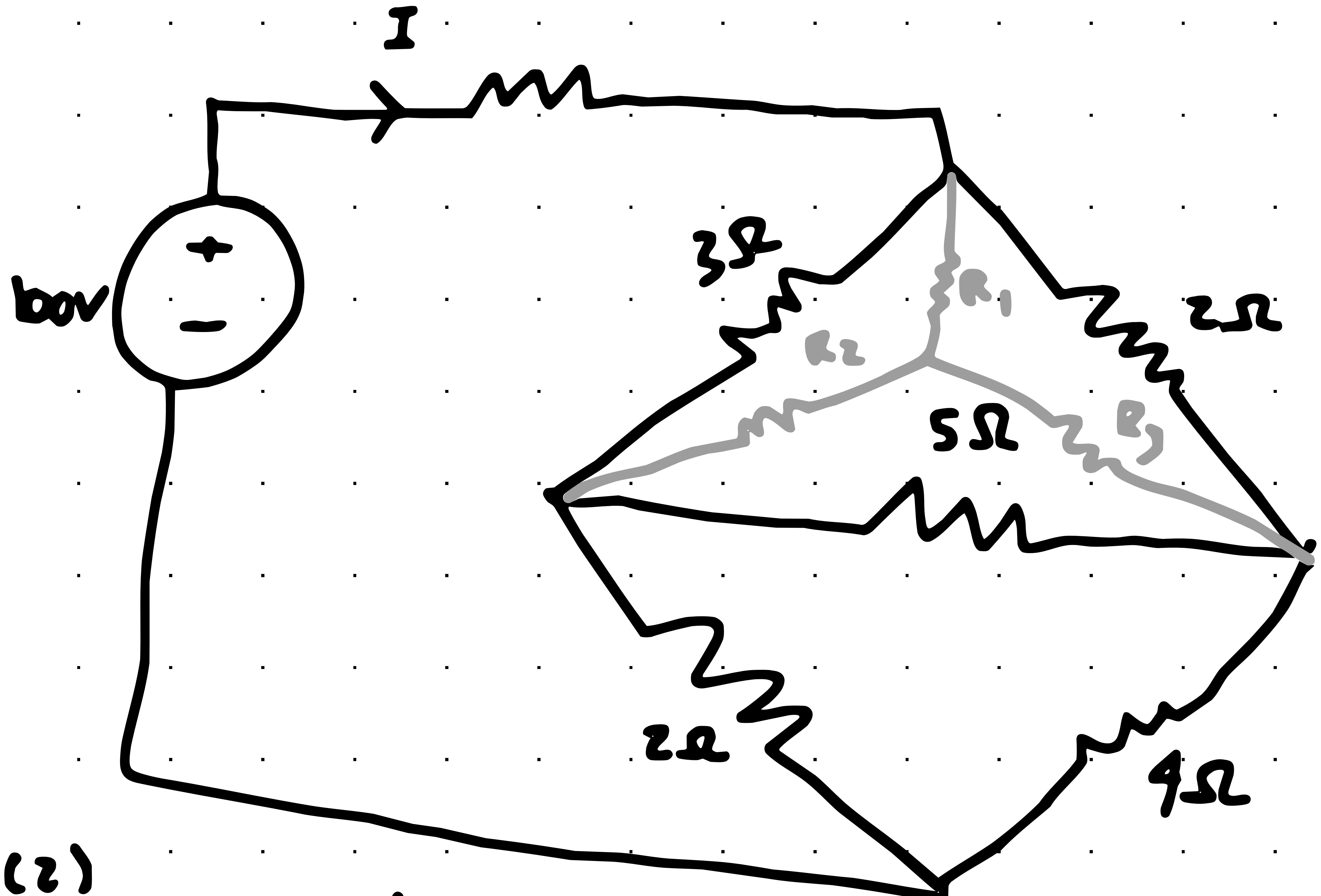


1) Identify the delta connection

2) Convert it into a wye connection



As such :)

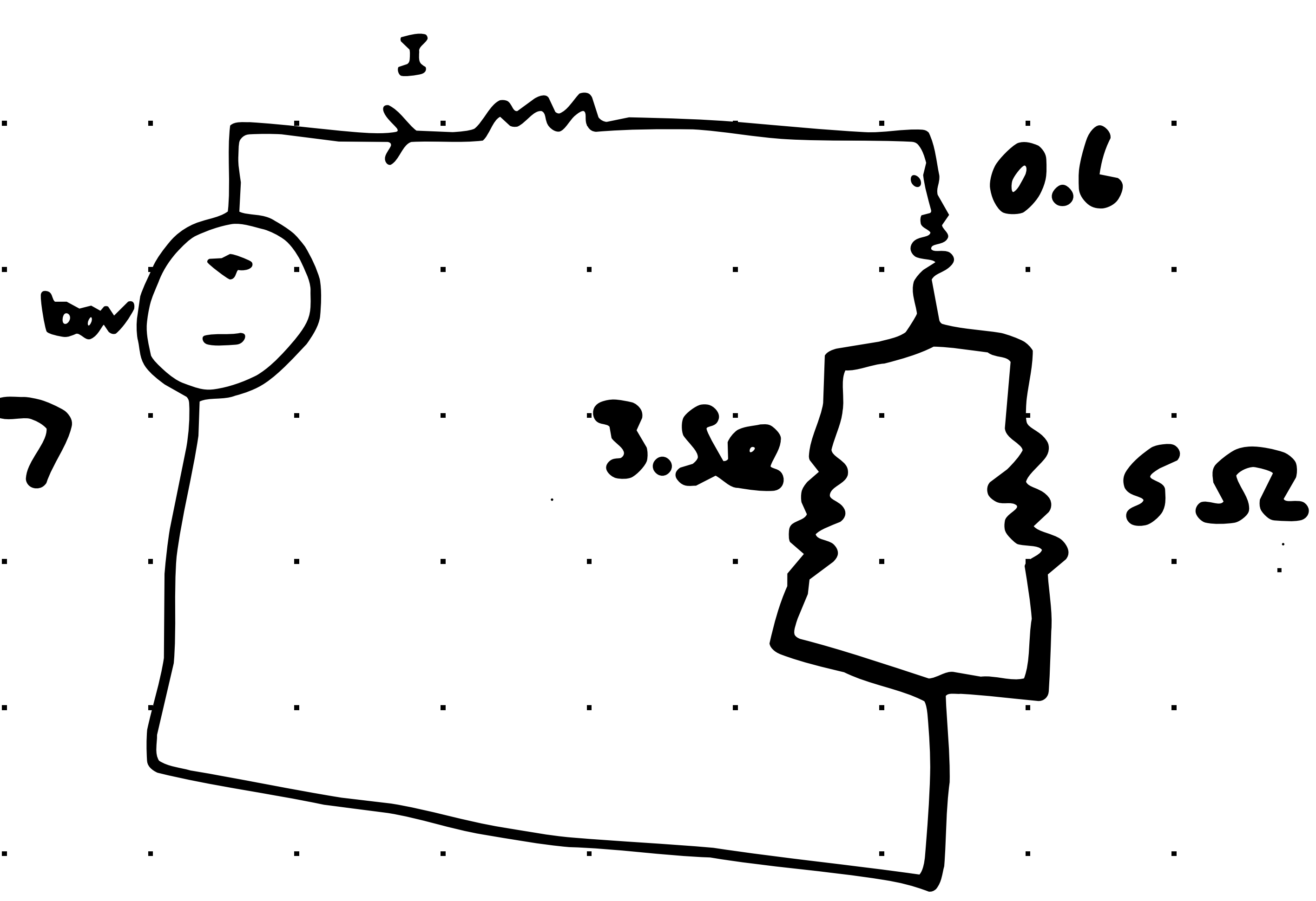


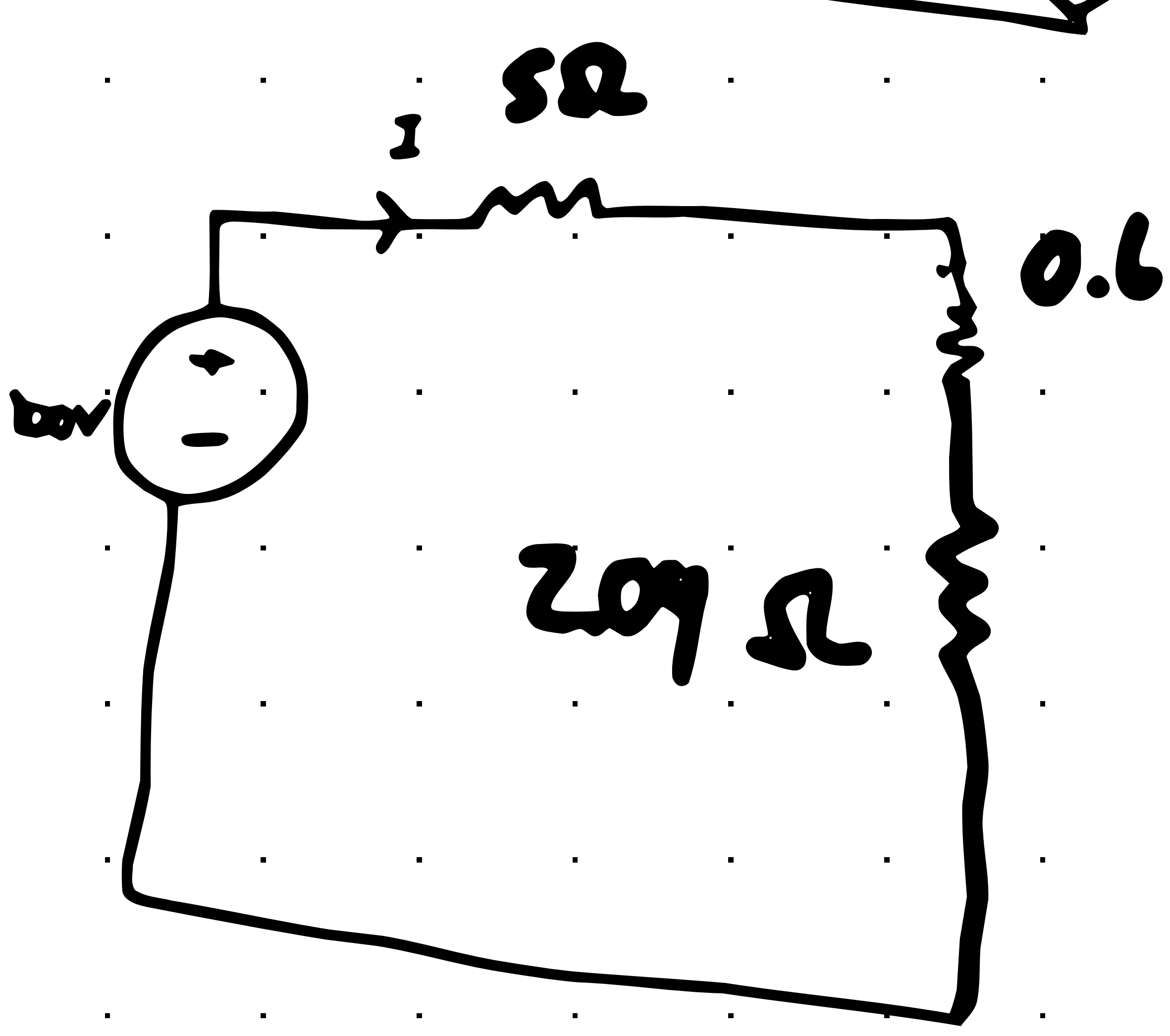
$$R_1 = \frac{3(2)}{3+2+5} = 0.6\Omega$$

$$R_2 = \frac{3(5)}{3+2+5} = 1.5\Omega$$

$$R_3 = \frac{2(5)}{3+2+5} = 1\Omega$$

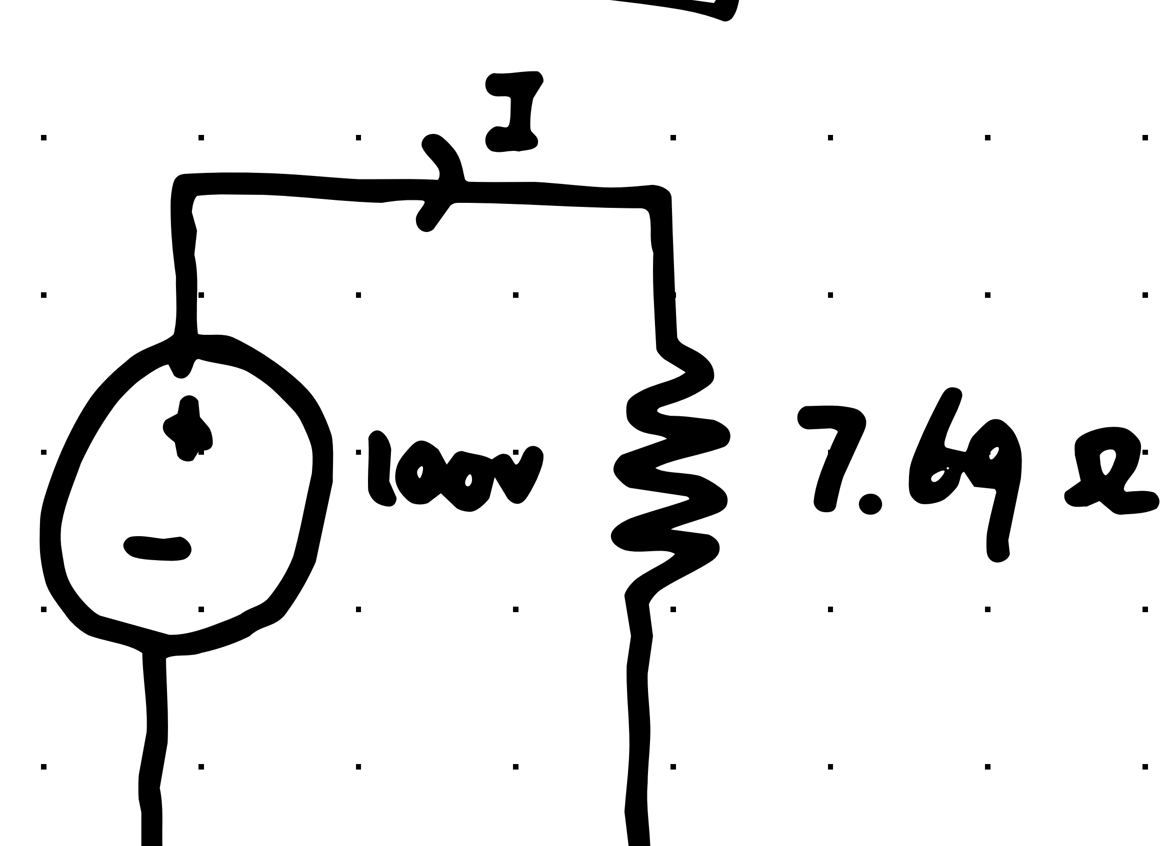
$\longrightarrow$





$$\frac{(3.5)(7)}{3.5+7} = 2.09\Omega$$

$\longrightarrow$



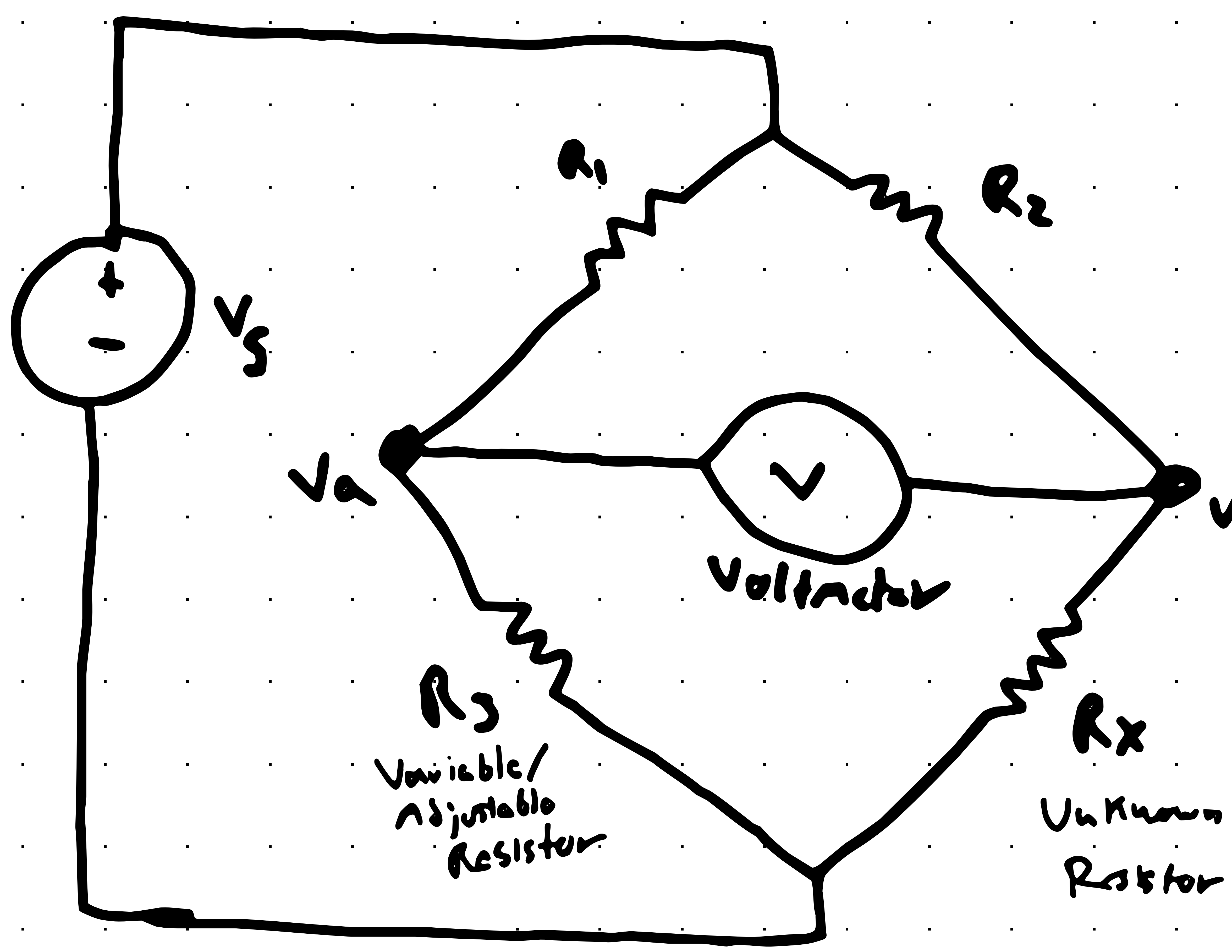
$V = IR$

$100 = I(7.69)$

$I = 13A$

Practical Example of Voltage Divider

- Resistance Measurement using a Wheatstone



If the voltmeter reads <u>0 volts</u> in the middle there, that means that V_a and V_b are equal!

$$V_a - V_b = 0 \longrightarrow V_a = V_b$$

<u>Voltage Divider</u>

$$V_a = V_S\left(\frac{R_3}{R_1 + R_3}\right), \quad V_b = V_S\left(\frac{R_X}{R_2 + R_X}\right)$$

and since $V_a = V_b$...

$$\cancel{V_s}\left(\frac{R_3}{R_1+R_3}\right) = \cancel{V_s}\left(\frac{R_x}{R_2+R_x}\right)$$

(Va) (Vb)

$$R_3R_2 + \cancel{R_3R_x} = R_1R_x + \cancel{R_xR_3}$$

$$\boxed{R_x = \frac{R_2}{R_1}R_3}$$

Wheatston Bridge Resistance Measurement

- used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg including R_x