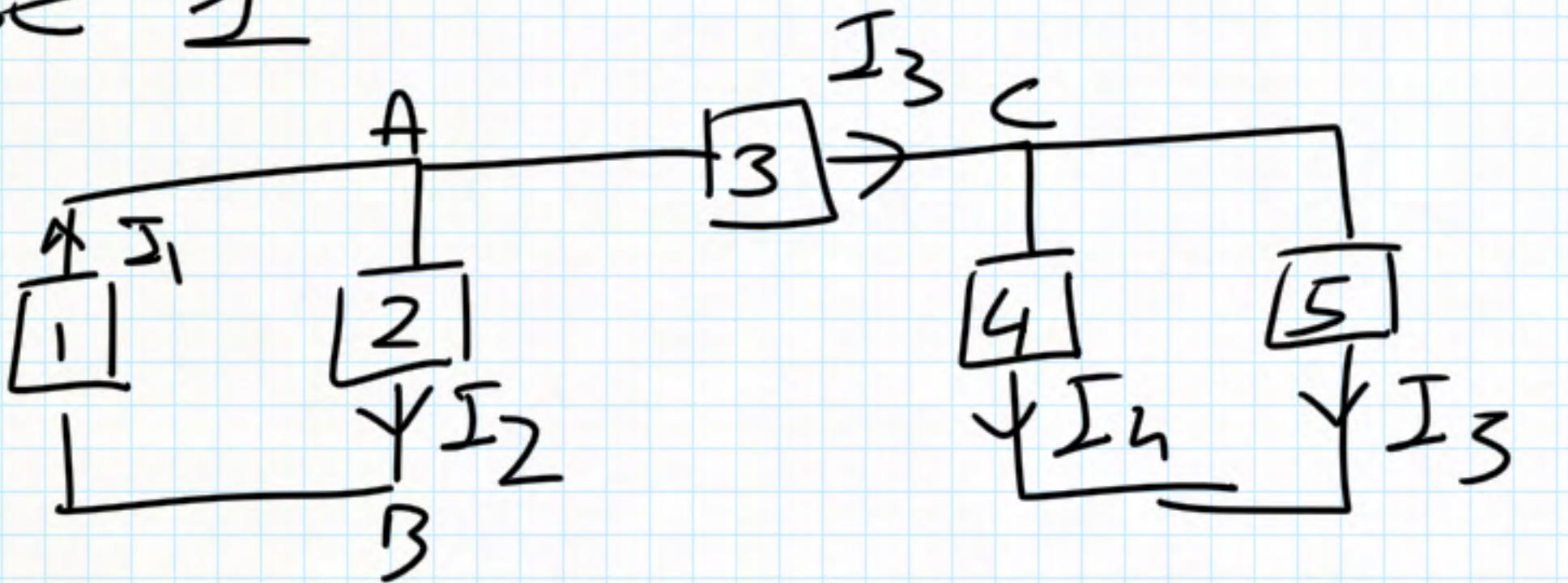


ESE 1



$$I_2 = I_1 = 1A$$

$$-I_5 = +I_4 = -3A$$

$$I_2 = 1A$$

$$I_5 = 3A$$

$$I_1 = ?$$

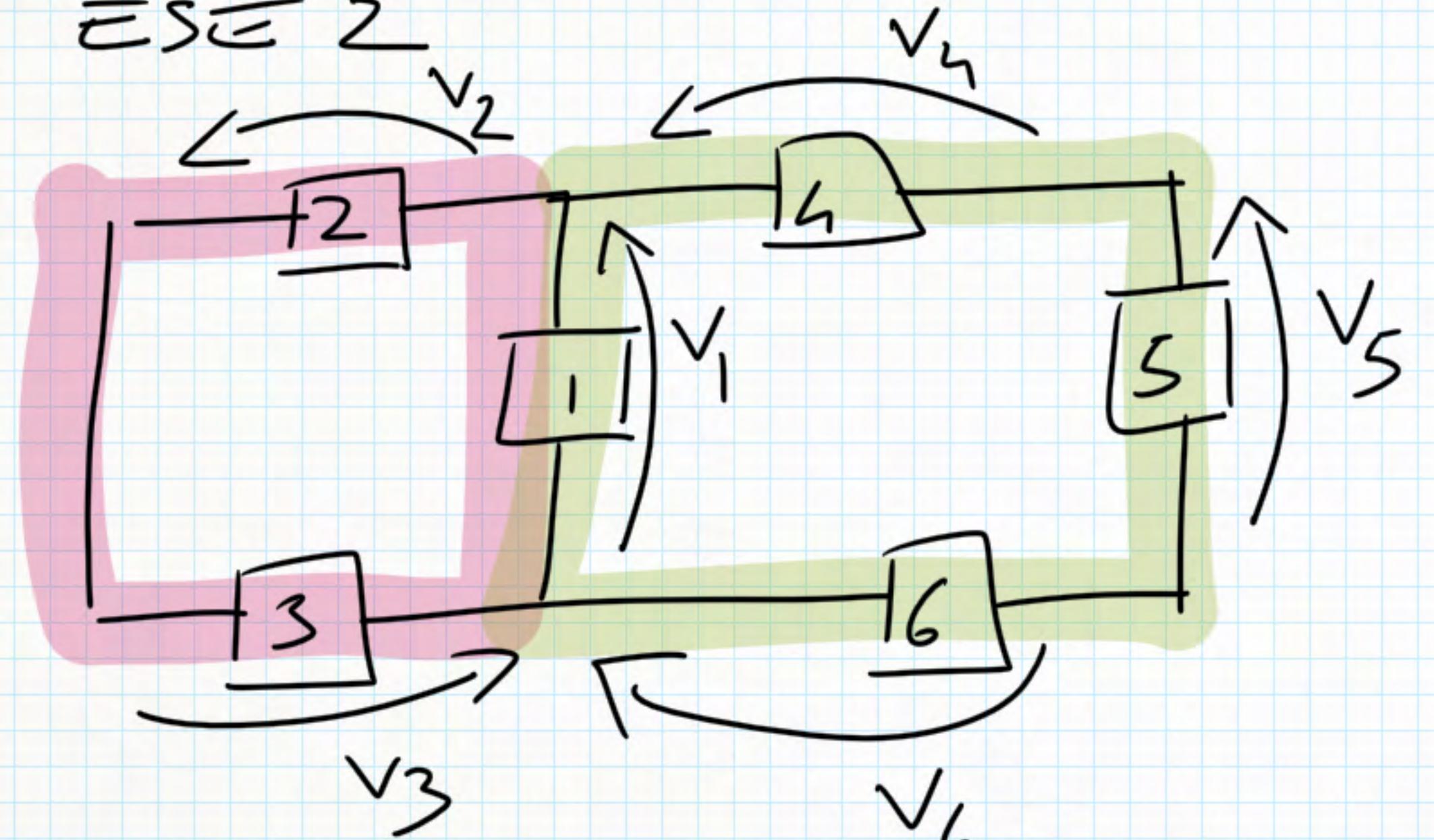
$$I_3 = ?$$

$$I_4 = ?$$

LkC A  $I_1 = I_2 + I_3 \Rightarrow I_3 = I_1 - I_2 = 0A$

LkC C  $I_3 = I_4 + I_5 = -I_5 + I_5 = 0A$

ESE 2



$$V_3 = 3V$$

$$V_4 = 6V$$

$$V_5 = 2V$$

$$V_6 = 5V$$

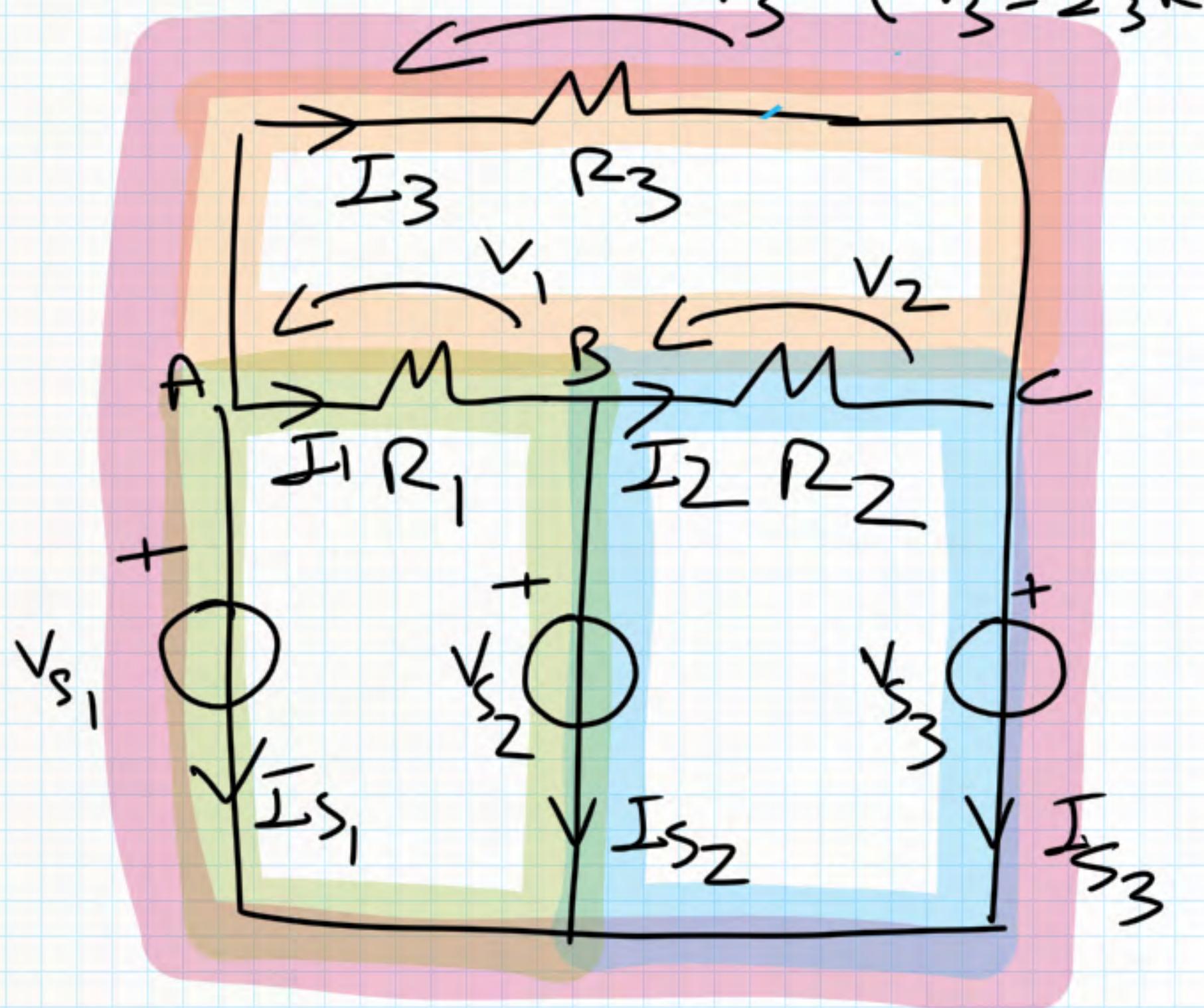
$$V_1 = ?$$

$$V_2 = ?$$

$$V_1 + V_6 = V_4 + V_5 \Rightarrow V_1 = V_4 + V_5 - V_6 = 3V$$

$$V_1 + V_2 + V_3 = 0V \Rightarrow V_2 = -V_1 - V_3 = -6V$$

$\Sigma V = 3$   $(V_3 = I_3 R_3)$



$$V_s = V_1 + V_{s2}$$

$$\Rightarrow V_1 = V_s - V_{s2} = -5V$$

$$V_{s1} = 5V$$

$$V_{s2} = 10V$$

$$V_{s3} = 5V$$

$$R_1 = R_2 = 100 \Omega$$

$$R_3 = 50 \Omega$$

$$I_1 = ? \quad I_2 = ? \quad I_3 = ?$$

$$I_{s1} = ? \quad I_{s2} = ? \quad I_{s3} = ?$$

$$V_1 = ? \quad V_2 = ? \quad V_3 = ?$$

VERIFICARE IL BILANCIO DELLE  
POTENZE

$$V_{S_2} = V_2 + V_{S_3} \Rightarrow V_2 = V_{S_2} - V_{S_3} = 5V$$

$$V_3 = V_1 + V_2 = 0V$$

$$V_{S_1} = V_3 + V_{S_3} \Rightarrow V_3 = V_{S_1} - V_{S_3} = 0V$$

$$V_1 = I_1 R_1 \Rightarrow I_1 = \frac{V_1}{R_1} = -\frac{1}{20} A$$

$$V_2 = I_2 R_2 \Rightarrow I_2 = \frac{V_2}{R_2} = \frac{1}{20} A$$

$$V_3 = I_3 R_3 \Rightarrow I_3 = \frac{V_3}{R_3} = 0A$$

$$\text{LKC A} \quad I_3 + I_1 + I_{S1} = 0 \Rightarrow I_{S1} = -I_3 - I_1 = -I_1 = \frac{1}{20} \text{ A}$$

$$\text{LKC B} \quad I_1 = I_{S2} + I_2 \Rightarrow I_{S2} = I_1 - I_2 = -\frac{1}{10} \text{ A}$$

$$\text{LKC C} \quad I_3 + I_2 = I_{S3} \Rightarrow I_{S3} = I_2 = \frac{1}{20} \text{ A}$$

$$P_{R1} = V_1 I_1 = \frac{1}{5} W$$

$$P_{R2} = V_2 I_2 = \frac{1}{5} W$$

$$P_{R3} = V_3 I_3 = 0 W$$

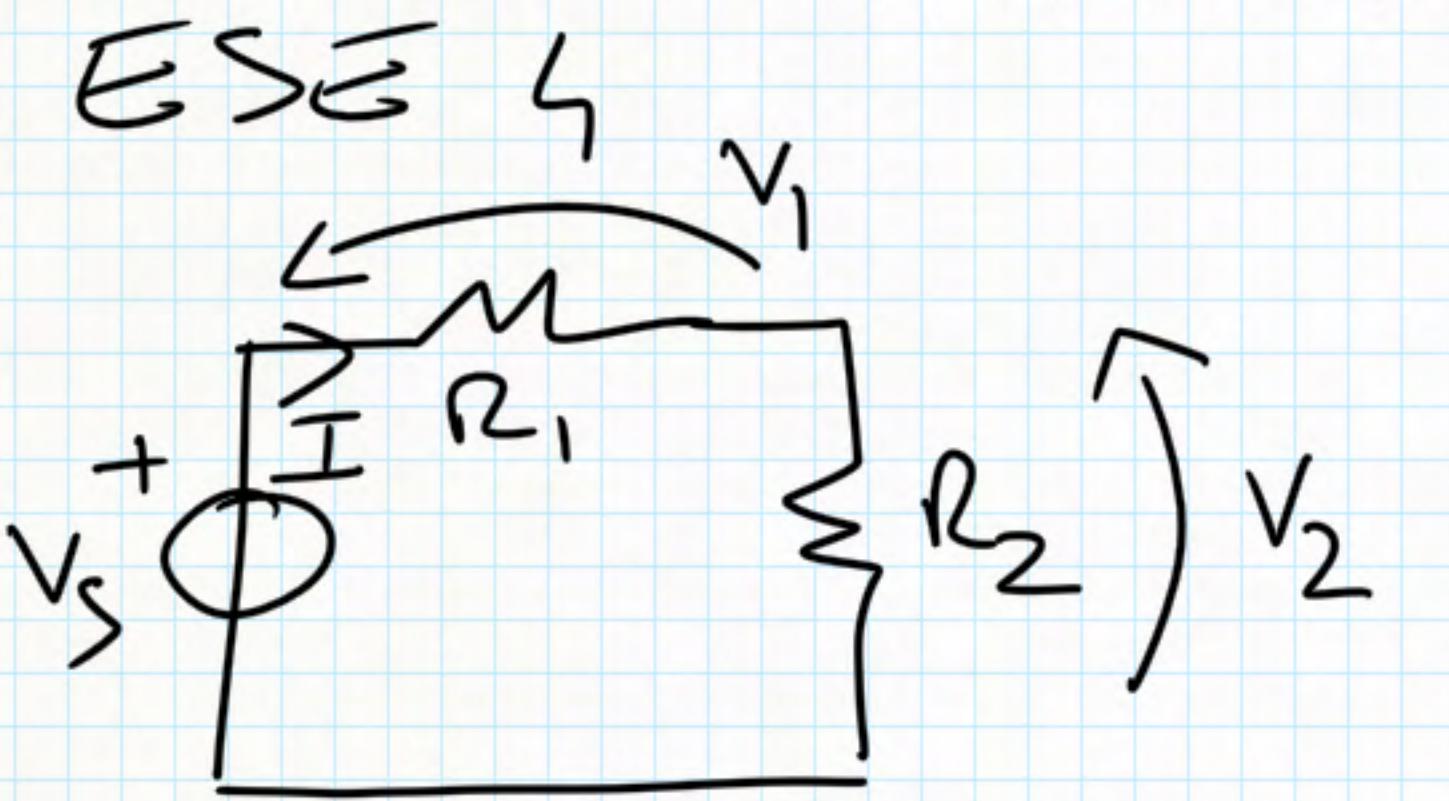
$$P_{S1} = V_{S1} I_{S1} = \frac{1}{5} W$$

$$P_{S2} = V_{S2} I_{S2} = -1 W$$

$$P_{S3} = V_{S3} I_{S3} = \frac{1}{5} W$$

$$\Rightarrow P_{R1} + P_{R2} + P_{R3} + P_{S1} + P_{S2} + P_{S3} = 0 \Rightarrow$$

OK!



PARTITORE DI TENSIONE

$$V_s = 20 \text{ V}$$

$$R_1 = 2 \Omega$$

$$R_2 = 3 \Omega$$

$$V_1 = ?$$

$$V_2 = ?$$

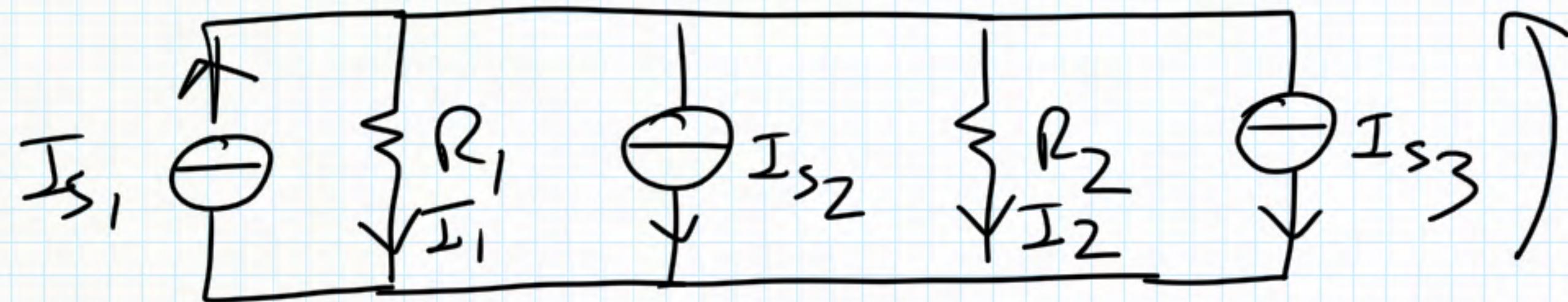
$$I = \frac{V_s}{R_1 + R_2}$$

$$V_1 = I R_1 = V_s \frac{R_1}{R_1 + R_2}$$

$$V_2 = I R_2 = V_s \frac{R_2}{R_1 + R_2}$$

$V_s$  +  $\left. \begin{array}{c} \nearrow I_1 \\ \overbrace{\quad\quad\quad}^{\{R_1\}} \end{array} \right\} R_1 \left. \begin{array}{c} \nearrow V_1 \\ \overbrace{\quad\quad\quad}^{\{R_1, R_2\}} \end{array} \right\} R_2 \left. \begin{array}{c} \nearrow V_2 \\ \vdots \\ \overbrace{\quad\quad\quad}^{\{R_N\}} \end{array} \right\} R_N V_1 = V_s \frac{R_1}{R_1 + R_2 + \dots + R_N}$   
 $V_2 = V_s \frac{R_2}{R_1 + R_2 + \dots + R_N}$   $V_2' = -V_2 = -V_s \frac{R_2}{R_1 + R_2 + \dots + R_N}$   
 $V_N = V_s \frac{R_N}{R_1 + R_2 + \dots + R_N}$

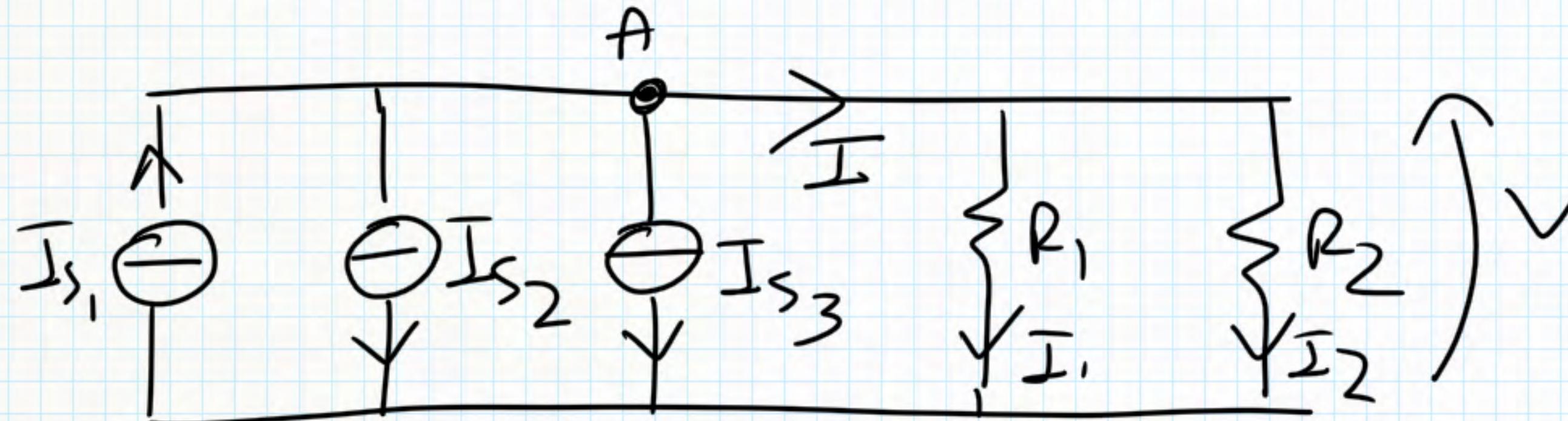
ESE 5



$$I_{S1} = 2 \text{ A}$$

$$I_{S2} = 3 \text{ A}$$

$$I_{S3} = 4 \text{ A}$$

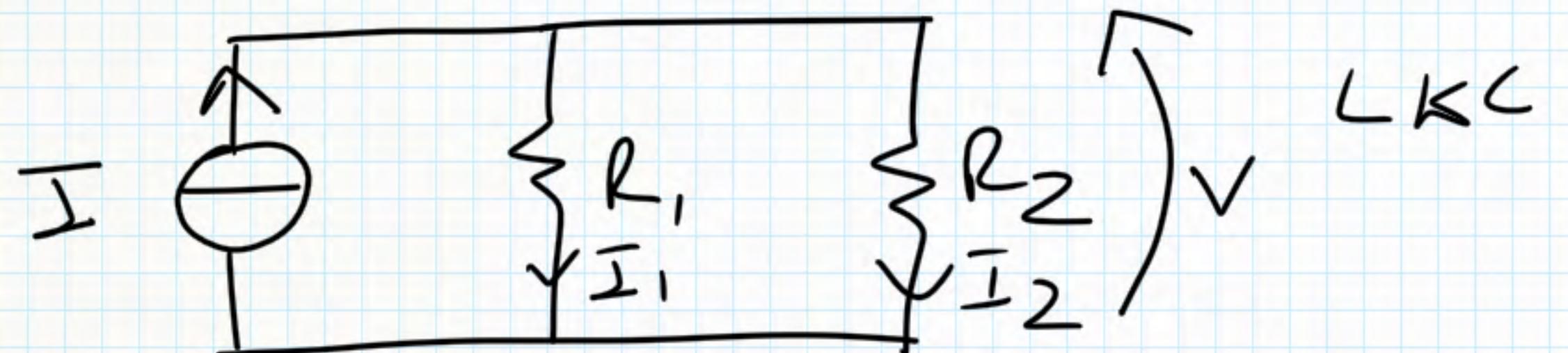


$$R_1 = 2 \Omega$$

$$R_2 = 3 \Omega$$

$$I_1 = ?$$

$$I_2 = ?$$



$$I_{S1} = I + I_{S3} + I_{S2} \Rightarrow$$

$$\Rightarrow I = I_{S1} - I_{S2} - I_{S3} = -5 \text{ A}$$

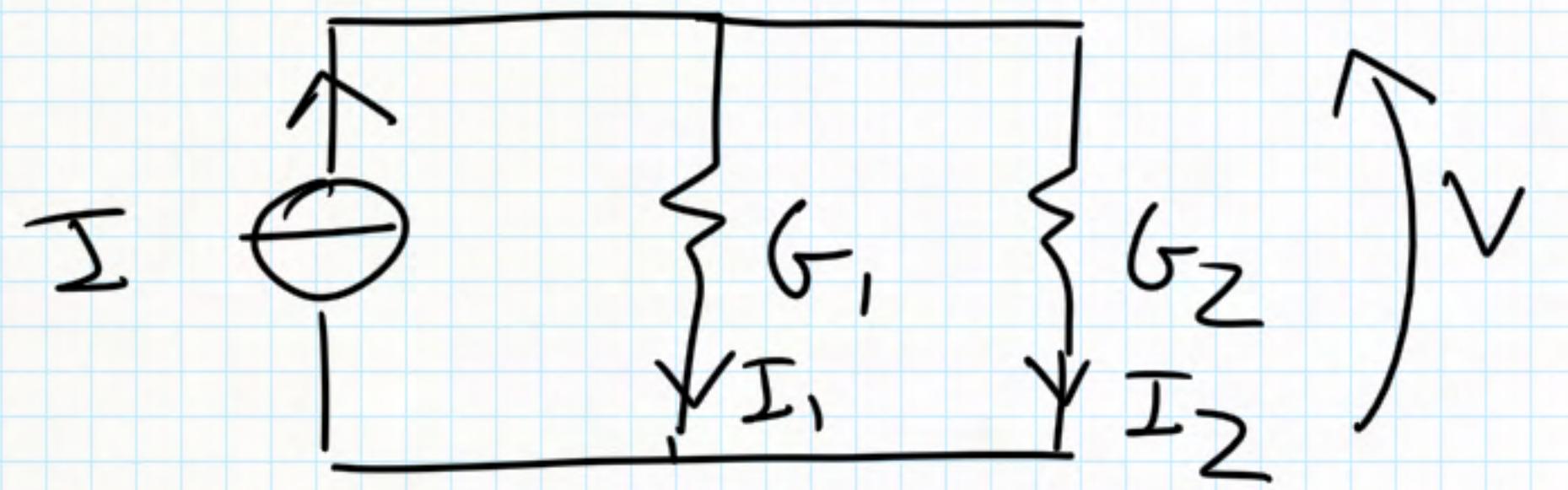
PARTITORE DI CORRENTE

$$R_1 // R_2 = \left( \frac{1}{R_1} + \frac{1}{R_2} \right)^{-1} = \frac{R_1 R_2}{R_1 + R_2} = \frac{6}{5} \Omega$$

$$V = I (R_1 // R_2) = -6V$$

$$I_1 = \frac{V}{R_1} = I \cdot \frac{1}{R_1} \cdot \frac{R_1 R_2}{R_1 + R_2} = I \frac{R_2}{R_1 + R_2}$$

$$I_2 = \frac{V}{R_2} = I \frac{R_1}{R_1 + R_2}$$



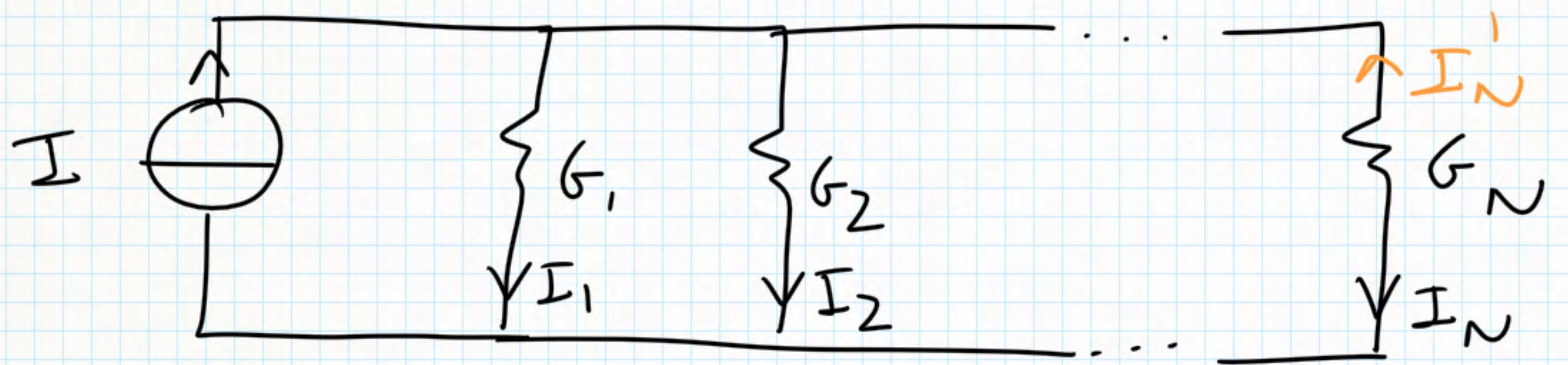
$$G_1 = \frac{1}{2} \Omega^{-1} = \frac{1}{2} S$$

$$G_2 = \frac{1}{3} \Omega^{-1} = \frac{1}{3} S$$

$$V = \frac{I}{G_1 + G_2}$$

$$I_1 = G_1 V = I - \frac{G_1}{G_1 + G_2} = I - \frac{\frac{1}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2}} = I - \frac{R_2}{R_1 + R_2}$$

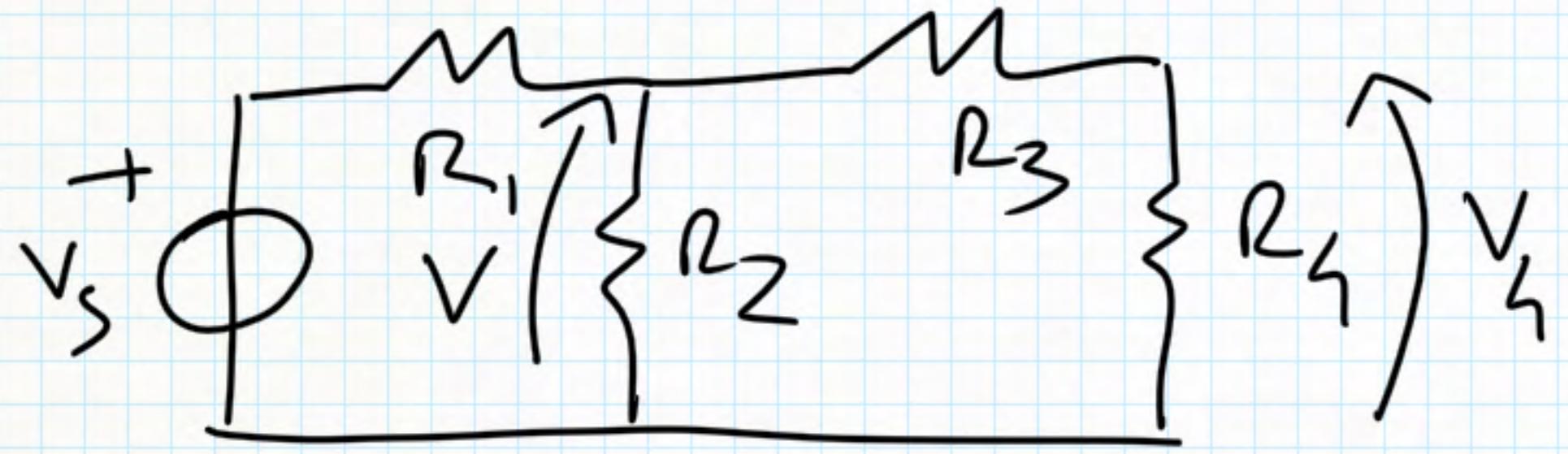
$$I_2 = G_2 V = I - \frac{G_2}{G_1 + G_2}$$



$$I_N = I \frac{G_N}{G_1 + G_2 + \dots + G_N}$$

$$I'_N = -I_N = -I \frac{G_N}{G_1 + G_2 + \dots + G_N}$$

ESE 6



$$V_s = 10V$$

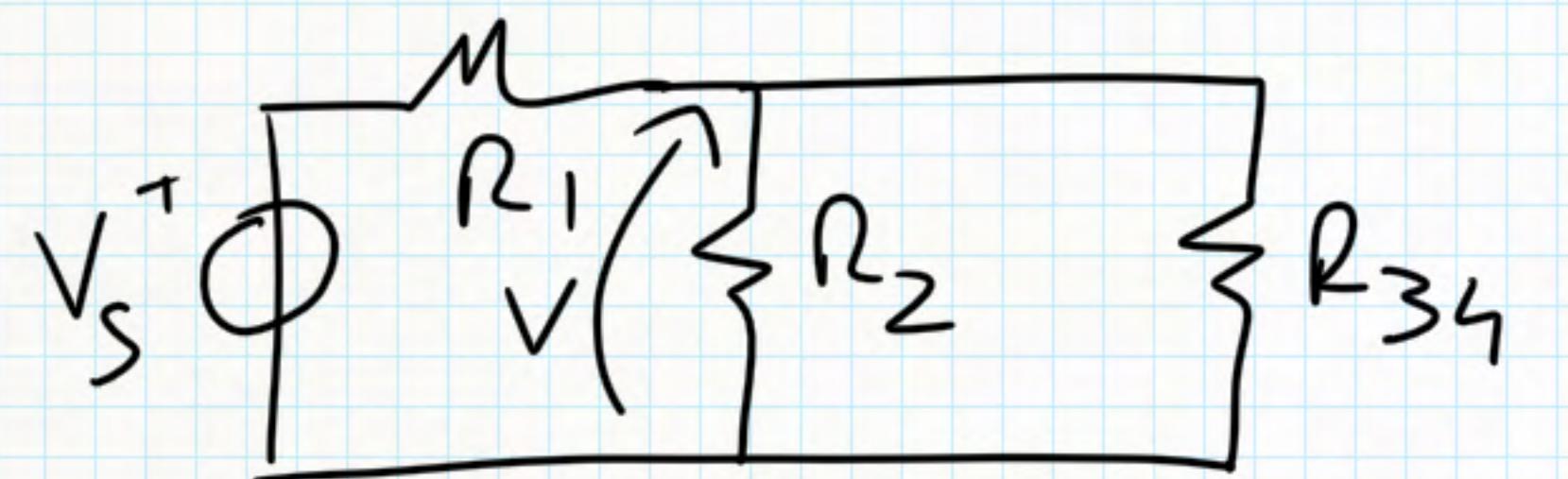
$$R_1 = 1\Omega$$

$$R_2 = 2\Omega$$

$$R_3 = 3\Omega$$

$$R_L = 1\Omega$$

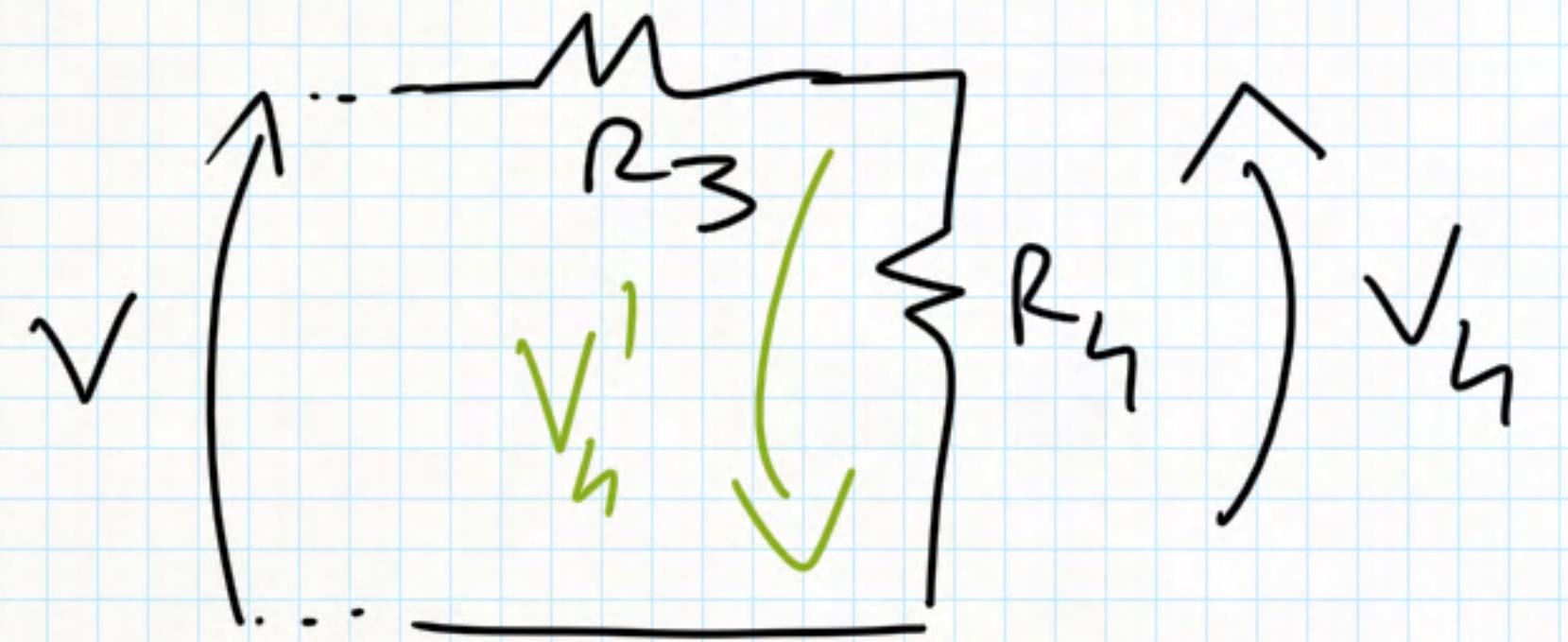
$$V_L = ?$$



$$R_{3L} = R_3 + R_L = 4\Omega$$

$$R_2 // R_{3L} = \frac{R_2 R_{3L}}{R_2 + R_{3L}} = \frac{8}{6}\Omega$$

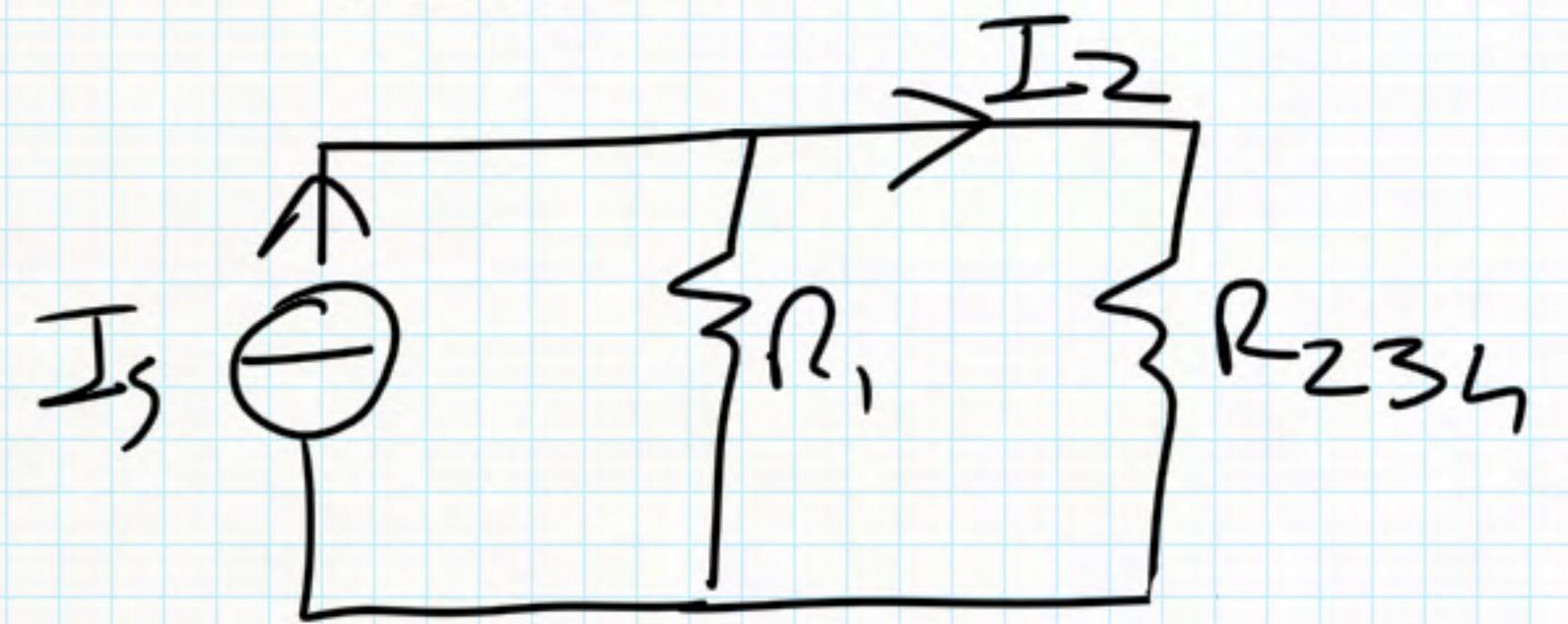
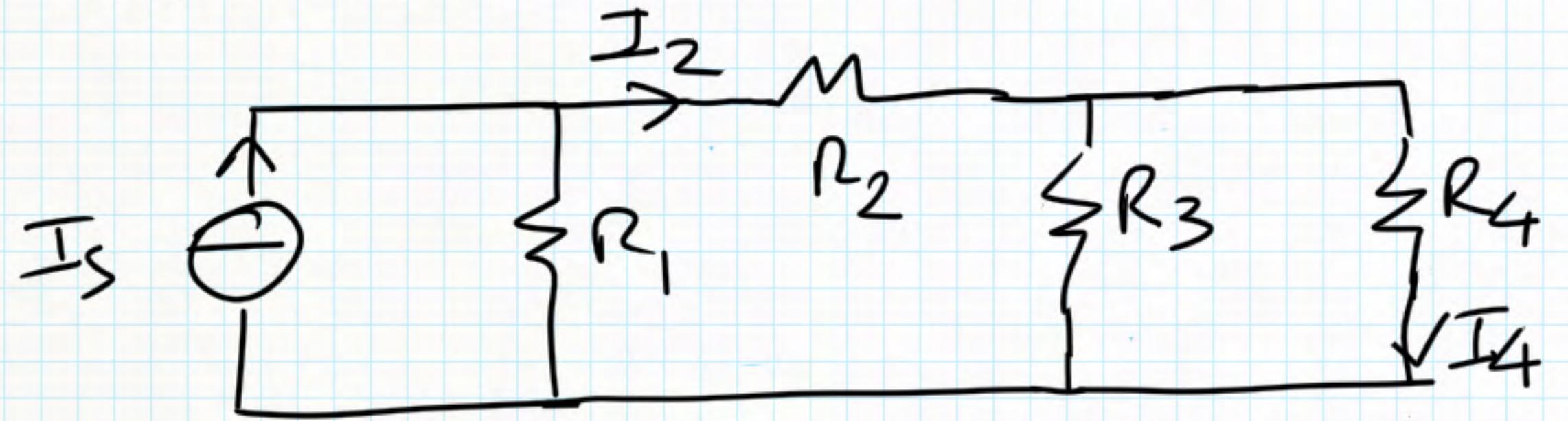
$$V = V_s \cdot \frac{R_2 // R_{3L}}{R_1 + R_2 // R_{3L}} = \frac{10}{7} \text{ V}$$



$$V_L = V \cdot \frac{R_L}{R_3 + R_L} = \frac{10}{7} \text{ V}$$

$$V'_L = -V_L = -\frac{10}{7} \text{ V}$$

ESE 7



$$I_s = 5A$$

$$R_1 = 3 \Omega$$

$$R_2 = 1 \Omega$$

$$R_3 = 2 \Omega$$

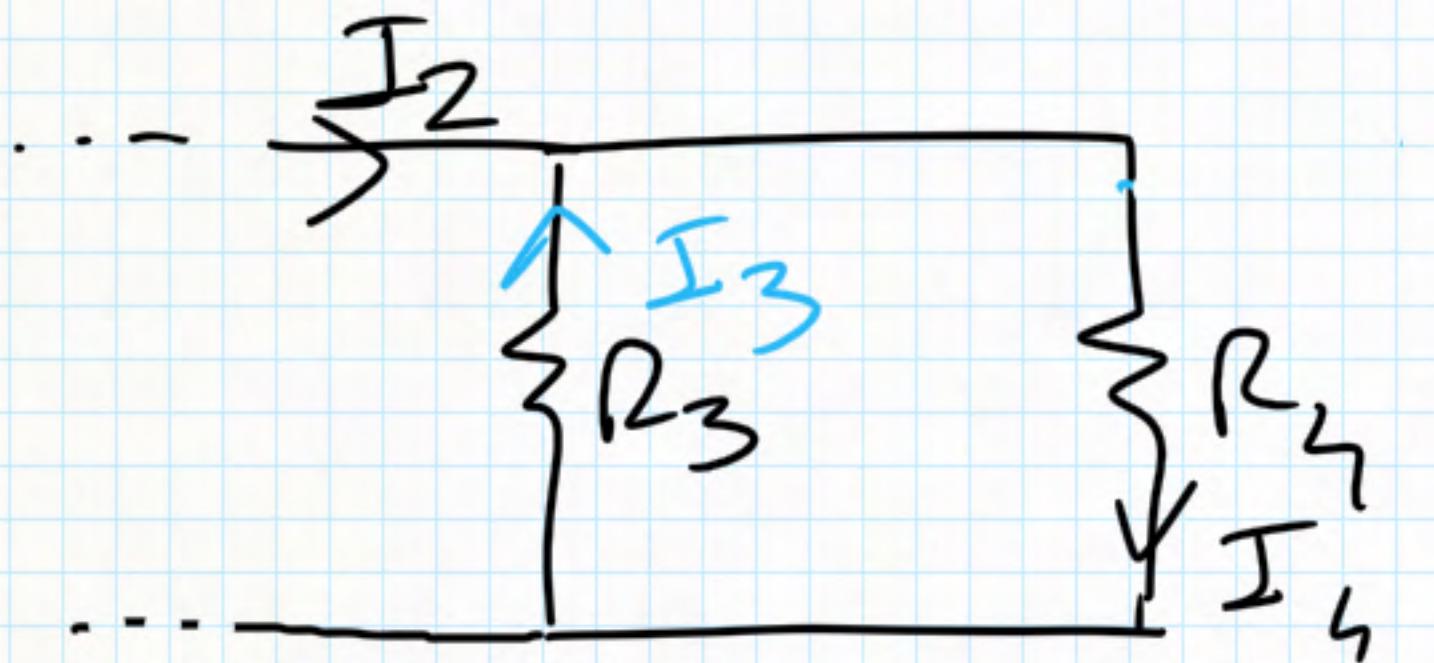
$$R_4 = 2 \Omega$$

$$I_2 = ?$$

$$I_4 = ?$$

$$R_{234} = R_2 + R_3 // R_4 = R_2 + \left( \frac{R_3 R_4}{R_3 + R_4} \right) = 2 \Omega$$

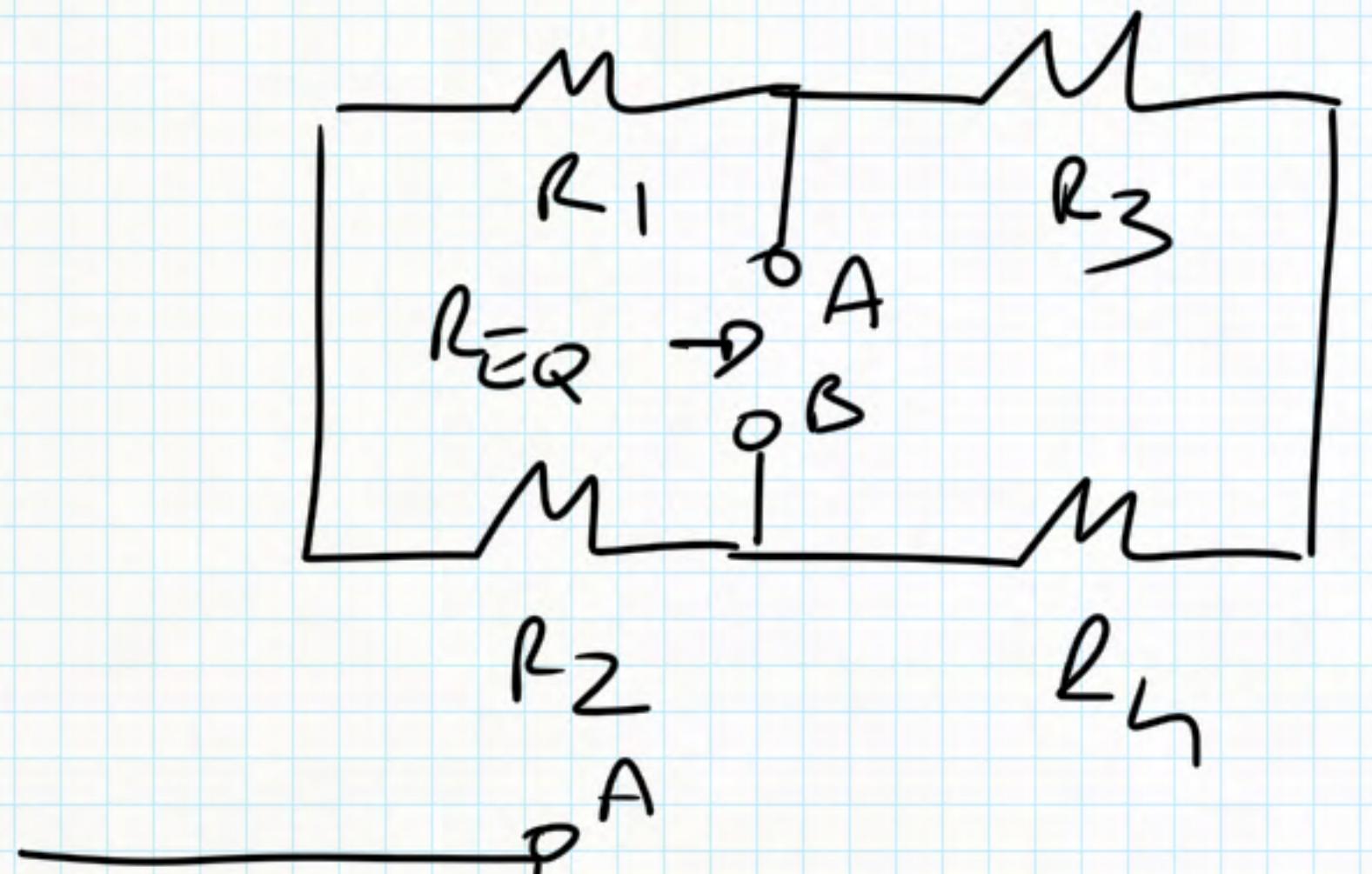
$$I_2 = I_s \frac{R_1}{R_1 + R_{234}} = 3 A$$



$$I_4 = I_2 \cdot \frac{R_3}{R_3 + R_4} = \frac{3}{2} \text{ A}$$

$$I_3 = -I_2 \cdot \frac{R_4}{R_3 + R_4} = -\frac{3}{2} \text{ A}$$

ES 8



$$R_1 = 2 \Omega$$

$$R_2 = 4 \Omega$$

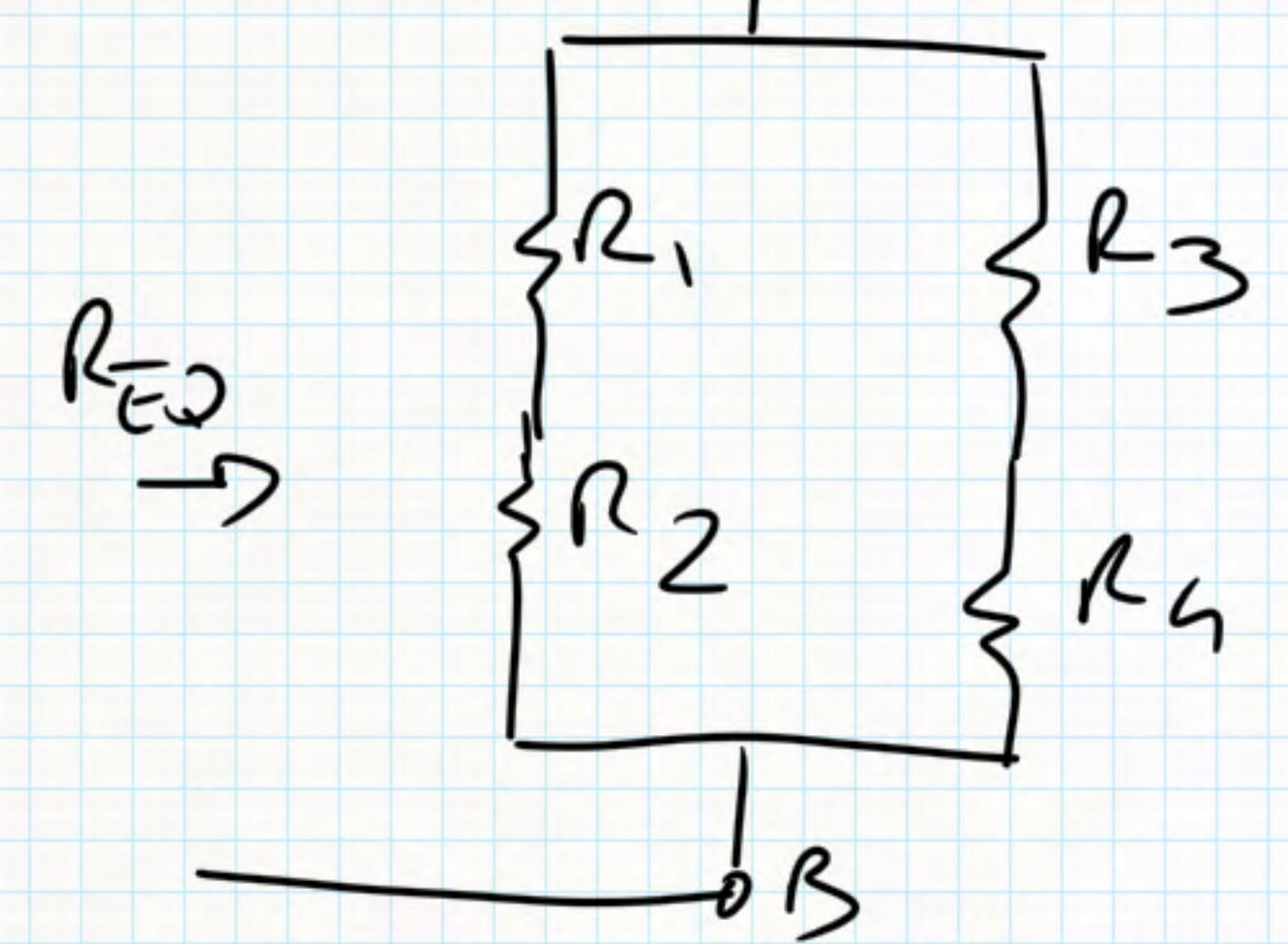
$$R_3 = 1 \Omega$$

$$R_4 = 1 \Omega$$

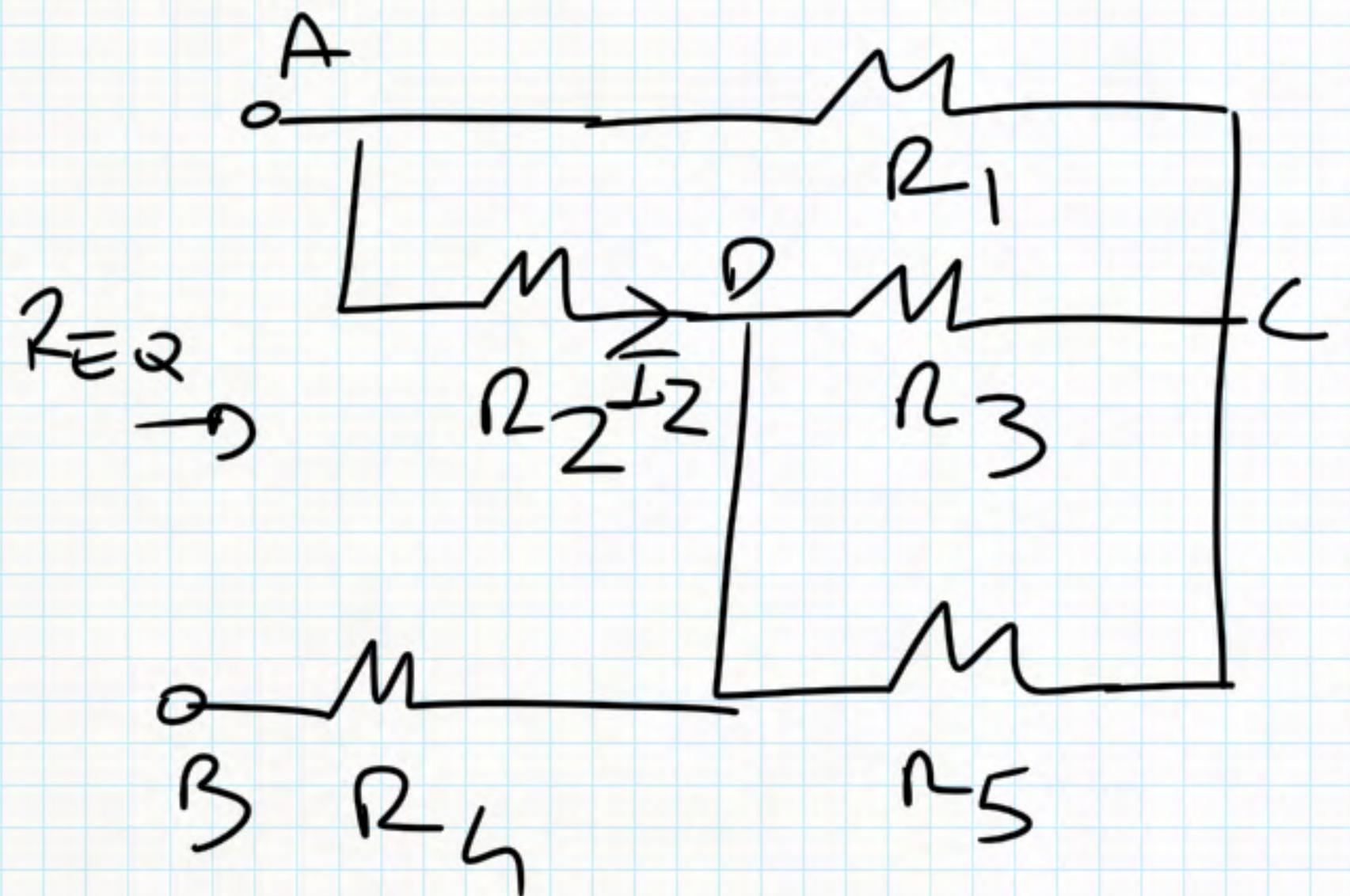
$$R_{EQ} = ?$$

$$R_1 + R_2 = 6 \Omega \quad ; \quad R_3 + R_4 = 2 \Omega$$

$$R_{EQ} = (R_1 + R_2) // (R_3 + R_4) = \frac{(R_1 + R_2)(R_3 + R_4)}{R_1 + R_2 + R_3 + R_4} = \frac{3}{2} \Omega$$



$ESE \rightarrow$



$$R_1 = \frac{2}{3} \Omega$$

$$R_2 = 2 \Omega$$

$$R_3 = 4 \Omega$$

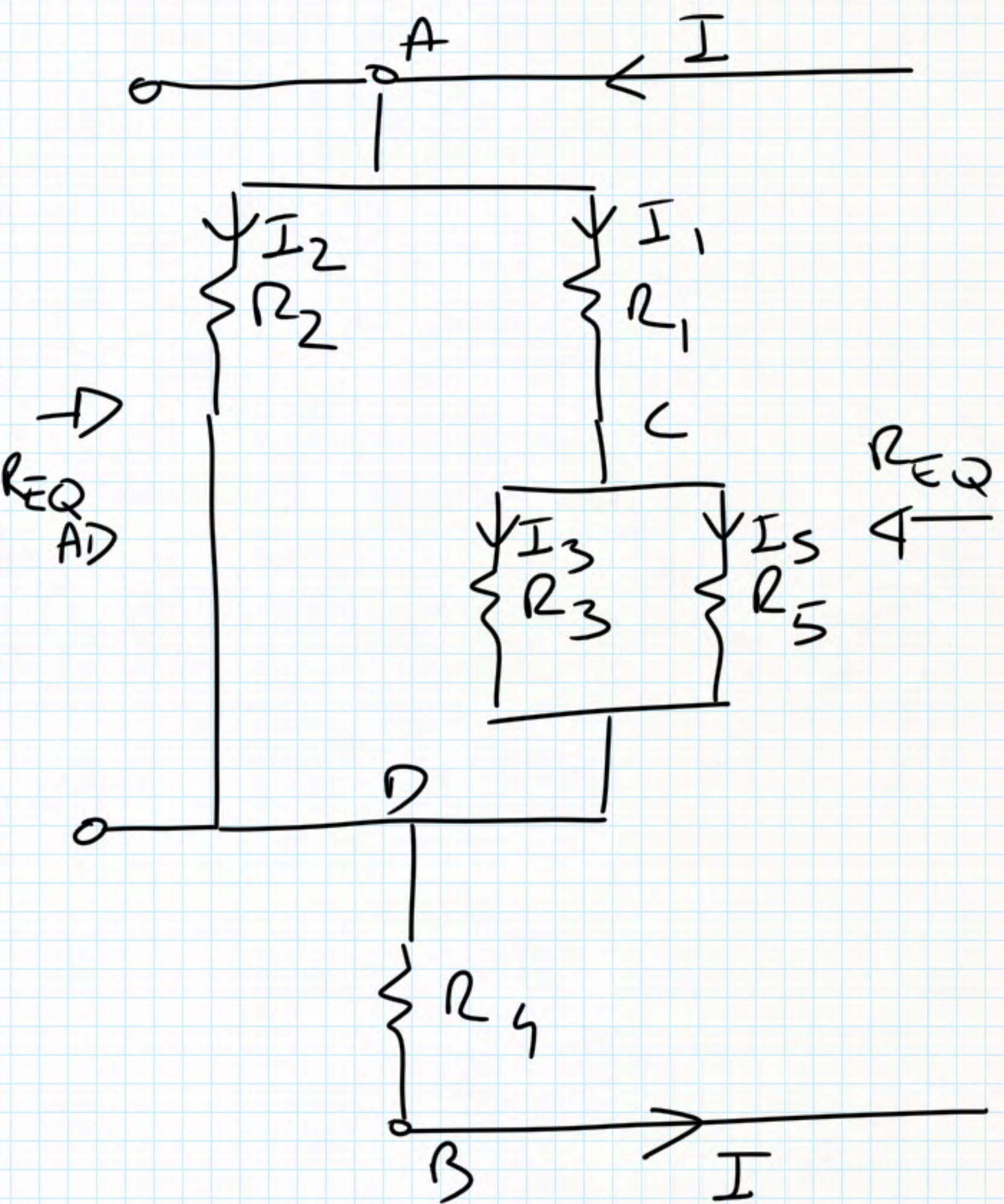
$$R_4 = 1 \Omega$$

$$R_5 = 2 \Omega$$

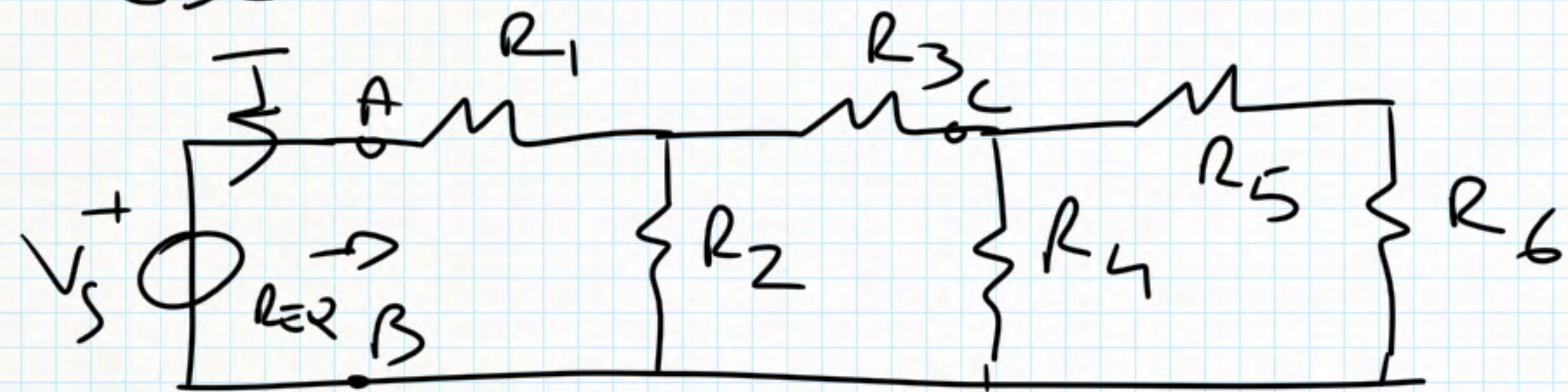
$$R_{EQ} = ?$$

$$R_{EQAD} = R_2 // [R_1 + R_3 // R_5]$$

$$R_{EQ} = R_4 + R_{EQAD} = 2 \Omega$$



ESE 10

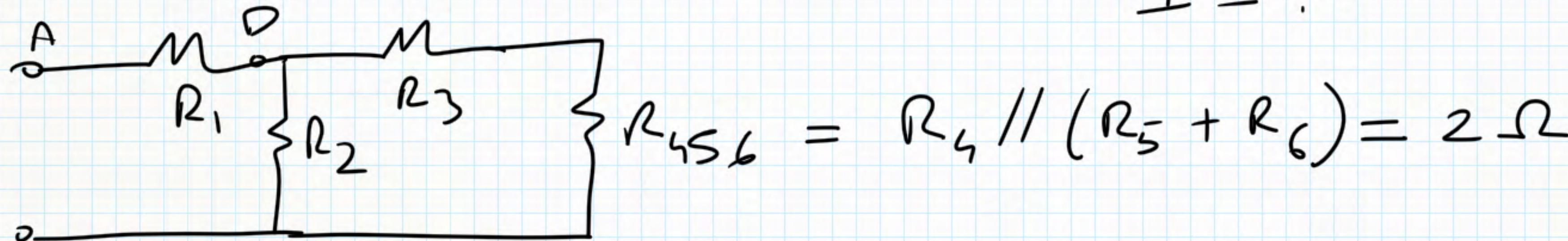


$$V_s = 50 \text{ V}$$

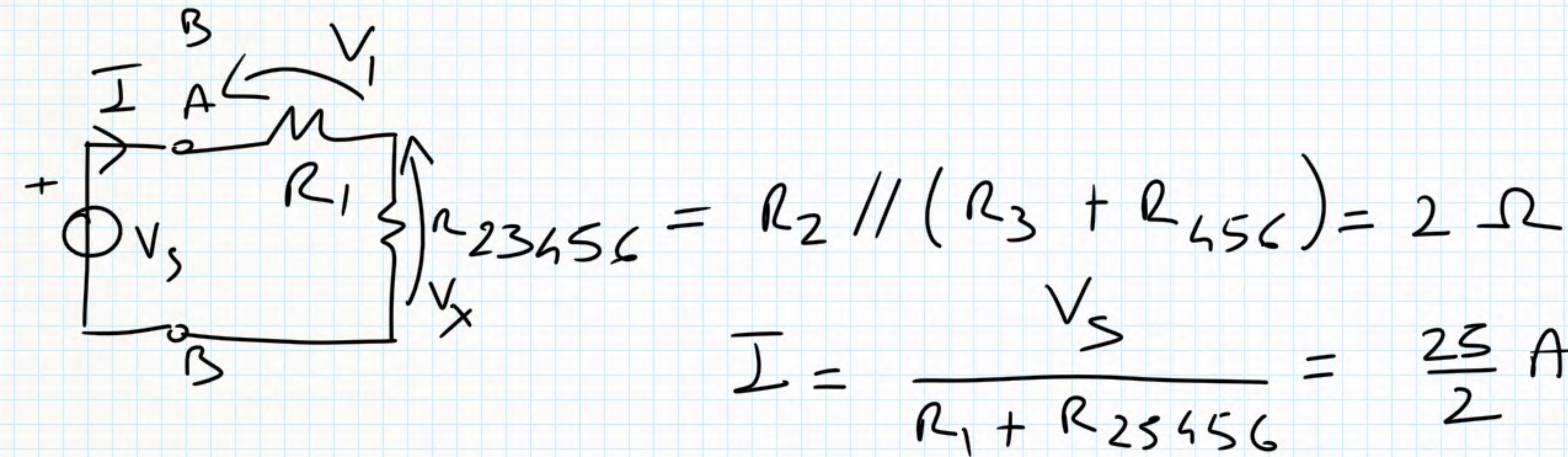
$$R_1 = R_3 = R_5 = R_6 = 2 \Omega$$

$$R_2 = R_4 = 1 \Omega$$

$$I = ?$$



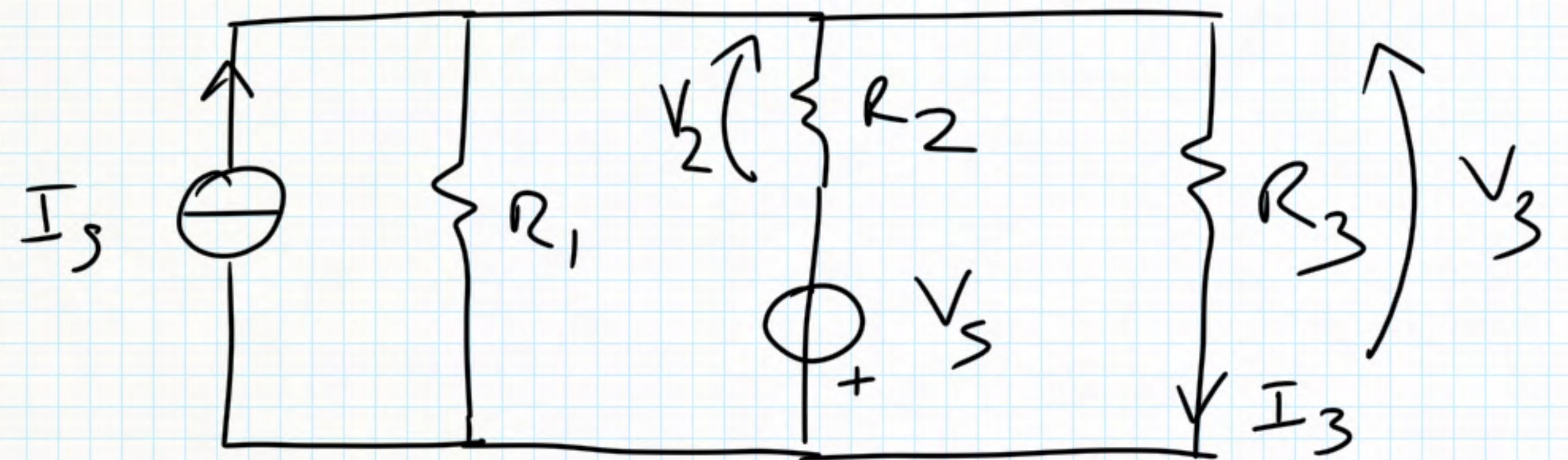
$$R_{456} = R_4 \parallel (R_5 + R_6) = 2 \Omega$$



$$R_{23456} = R_2 \parallel (R_3 + R_4 \parallel R_5 \parallel R_6) = 2 \Omega$$

$$I = \frac{V_s}{R_1 + R_{23456}} = \frac{25}{2} \text{ A}$$

ESE 11



USI AMO PSE

$$I_s = 4 \text{ A}$$

$$V_s = 3 \text{ V}$$

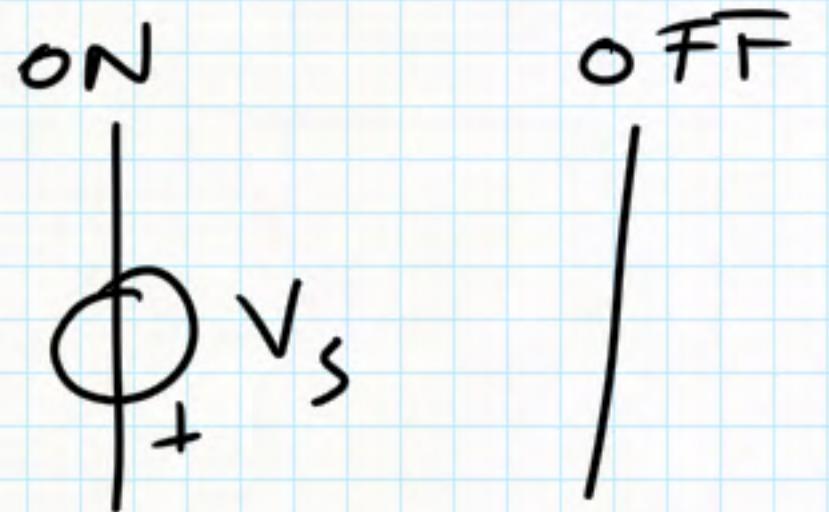
$$R_1 = R_2 = 2 \Omega$$

$$R_3 = 1 \Omega$$

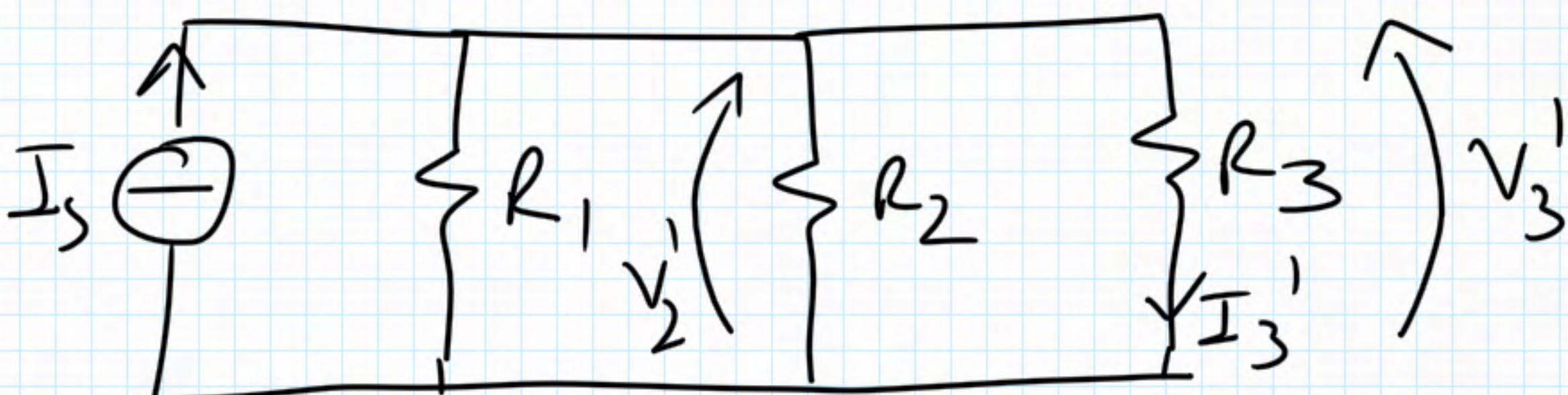
$$V_2 = ?$$

$$I_3 = ?$$

CASO 1 :  $V_s$  OFF  $I_s$  ON

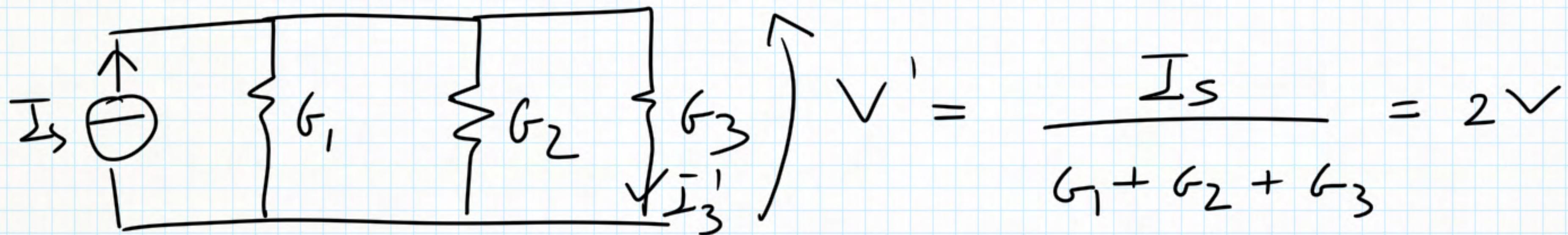


$\Rightarrow$



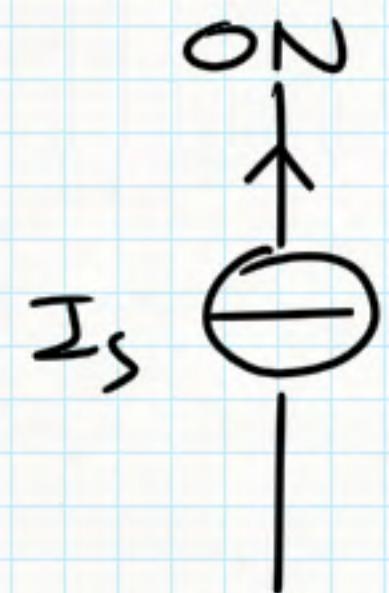
$$V'_2 = V'_3 = V'$$

$$G_1 = \frac{1}{R_1} = \frac{1}{2} S ; \quad G_2 = \frac{1}{R_2} = \frac{1}{2} S ; \quad G_3 = \frac{1}{R_3} = 1 S$$



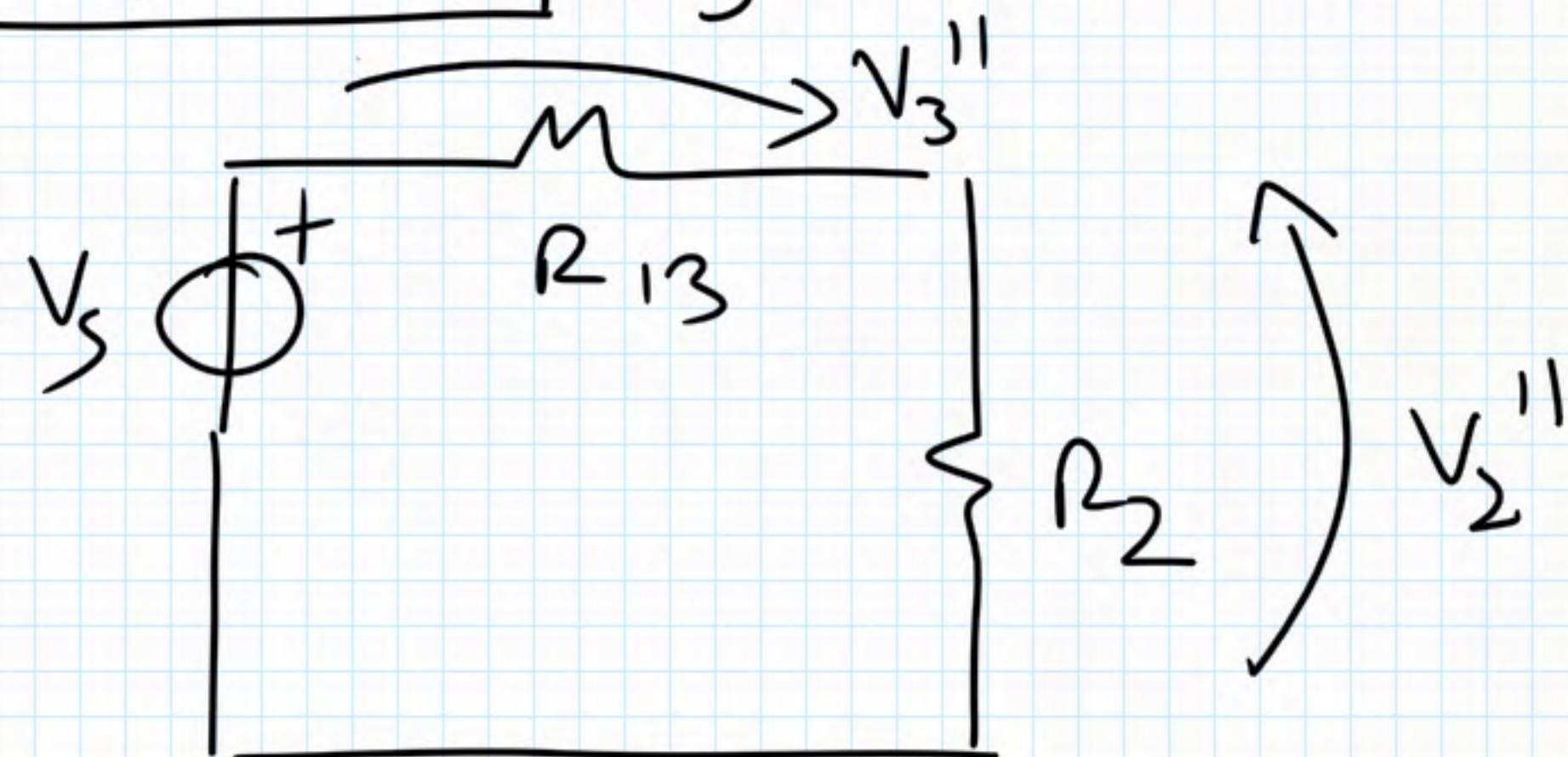
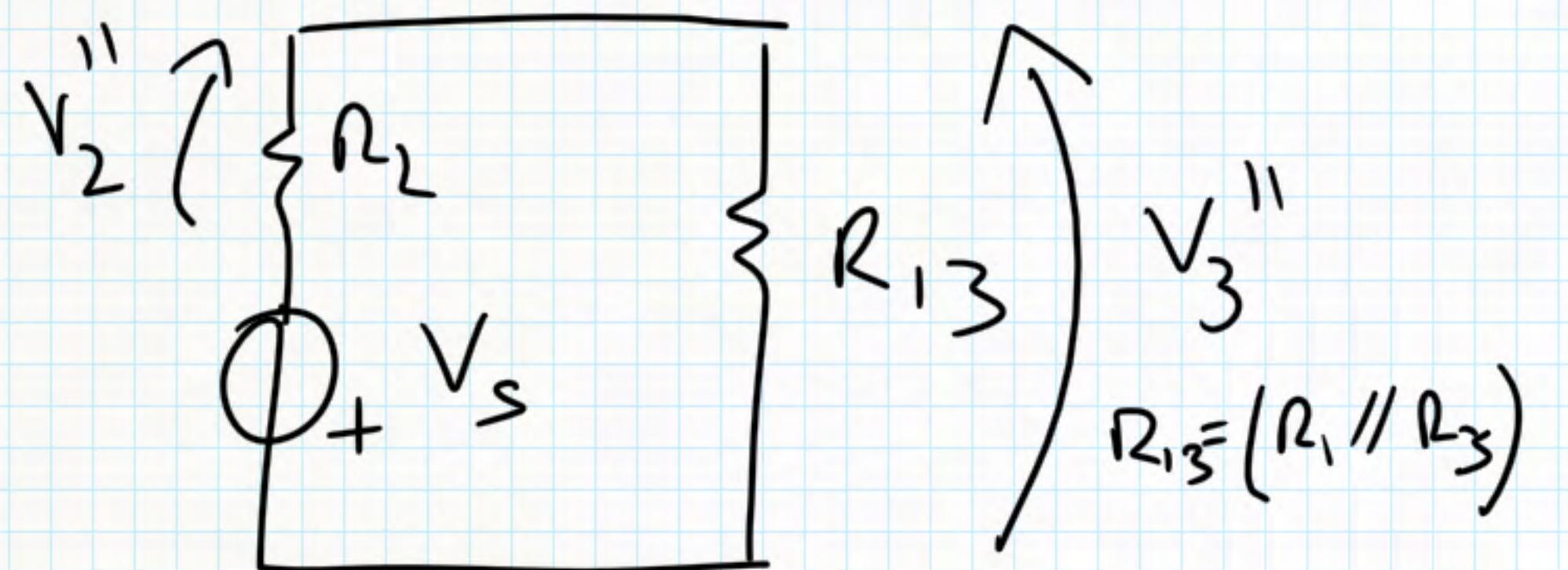
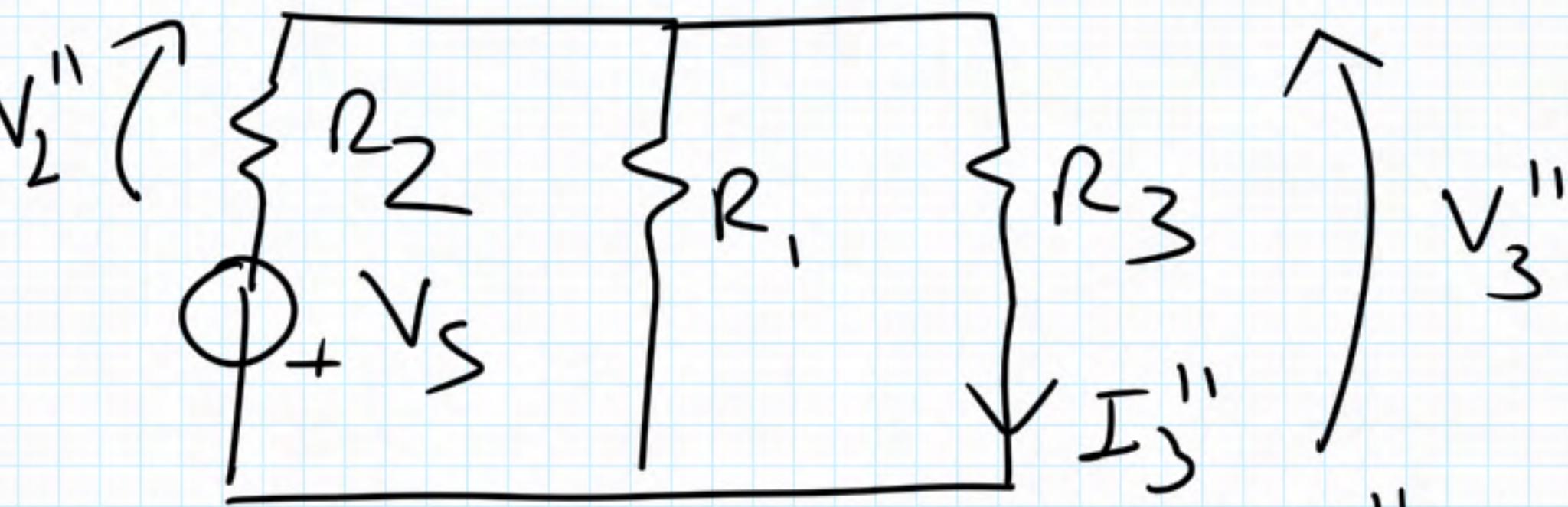
$$I'_3 = G_3 V' = I_s \frac{G_3}{G_1 + G_2 + G_3} = 2 A$$

CASO 2:  $V_S$  ON



$\overline{\text{OFF}}$

$I_S$  OFF



$$V_2'' = V_S \frac{R_2}{R_2 + R_{13}} = \frac{3}{5} V$$

$$V_3'' = - V_S \frac{R_{13}}{R_2 + R_{13}} = - \frac{3}{5} V = V_2'' - V_S$$

$$I_3'' = \frac{V_3''}{R_3} = -\frac{3}{5} A$$

$$V_2 = V_2' + V_2'' = \frac{17}{5} V$$

$$I_3 = I_3' + I_3'' = \frac{5}{5} A = \frac{V_3}{R_3}$$

$$V_3 = V_3' + V_3'' = \frac{5}{5} V$$