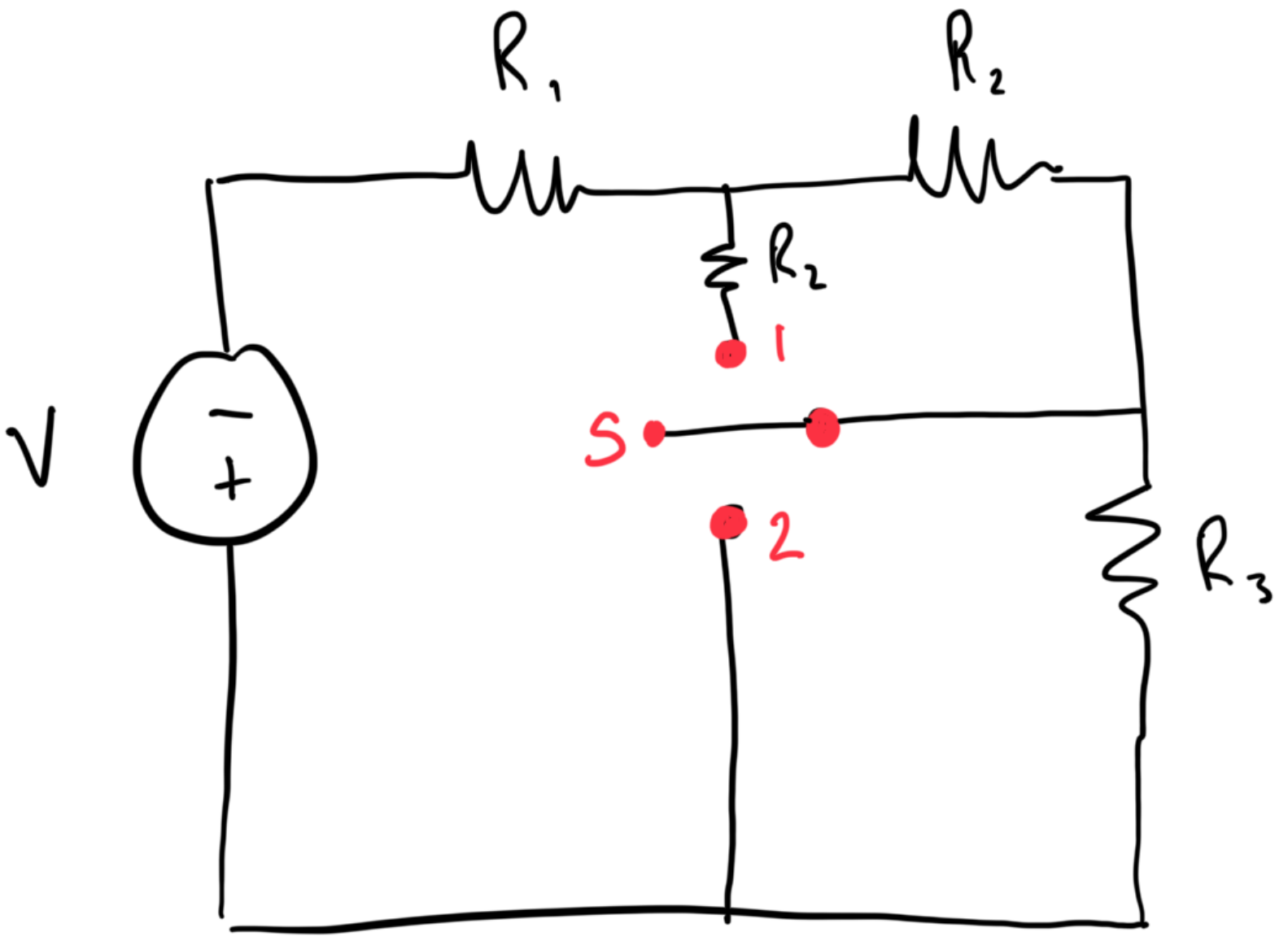
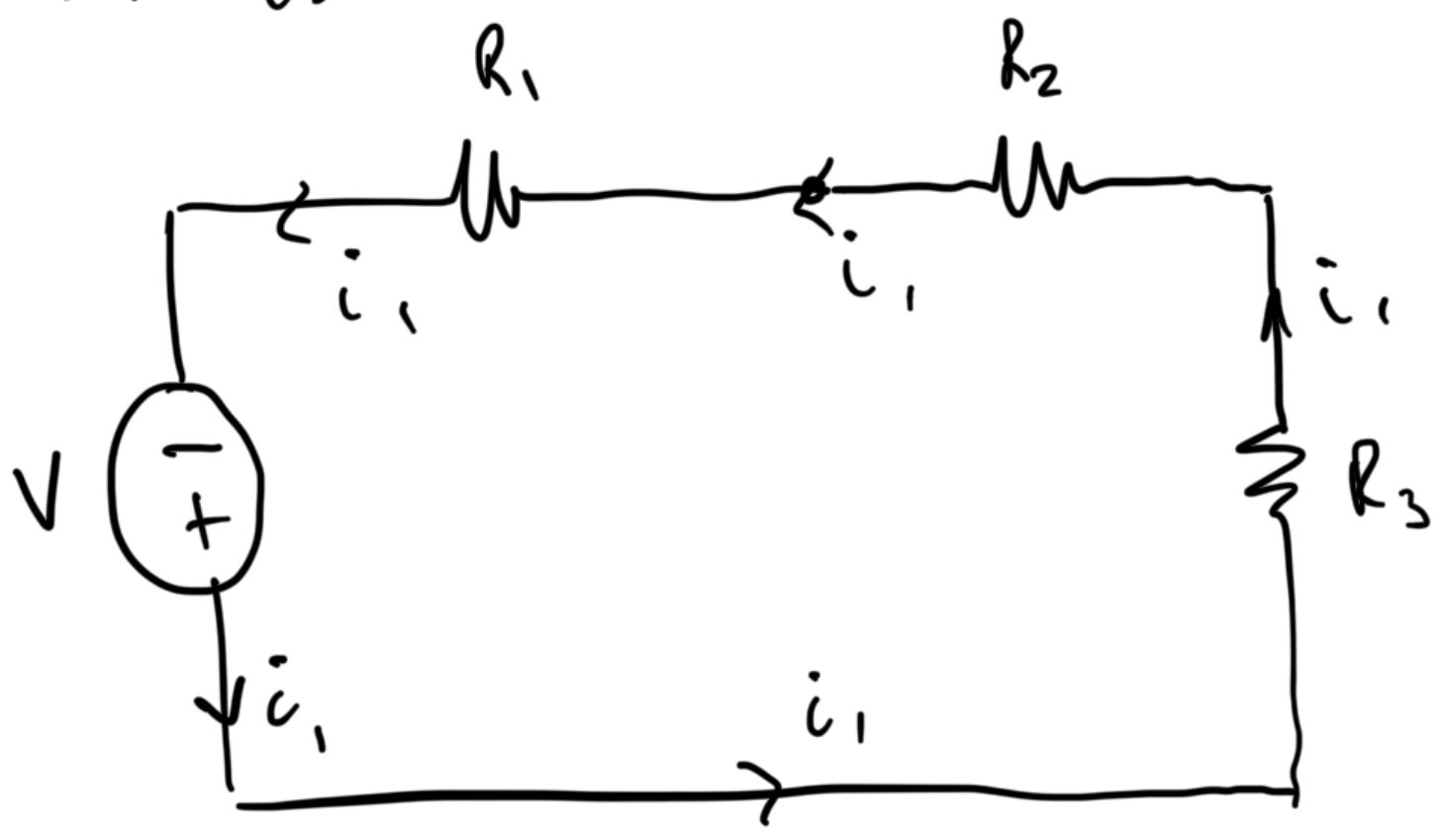
More Circuits

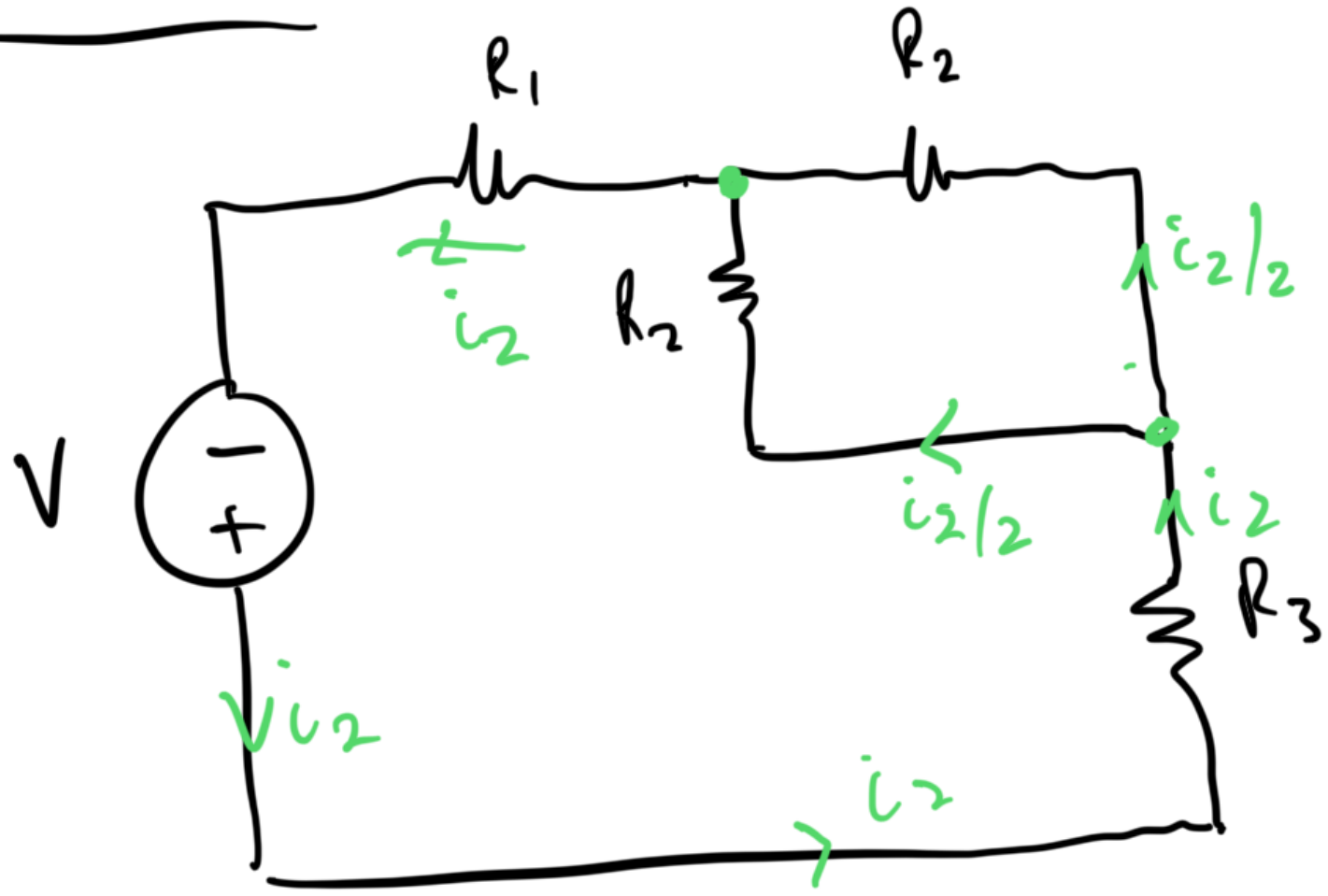


Position as shown:



$$i_1 = \frac{V}{R_1 + R_2 + R_3}$$

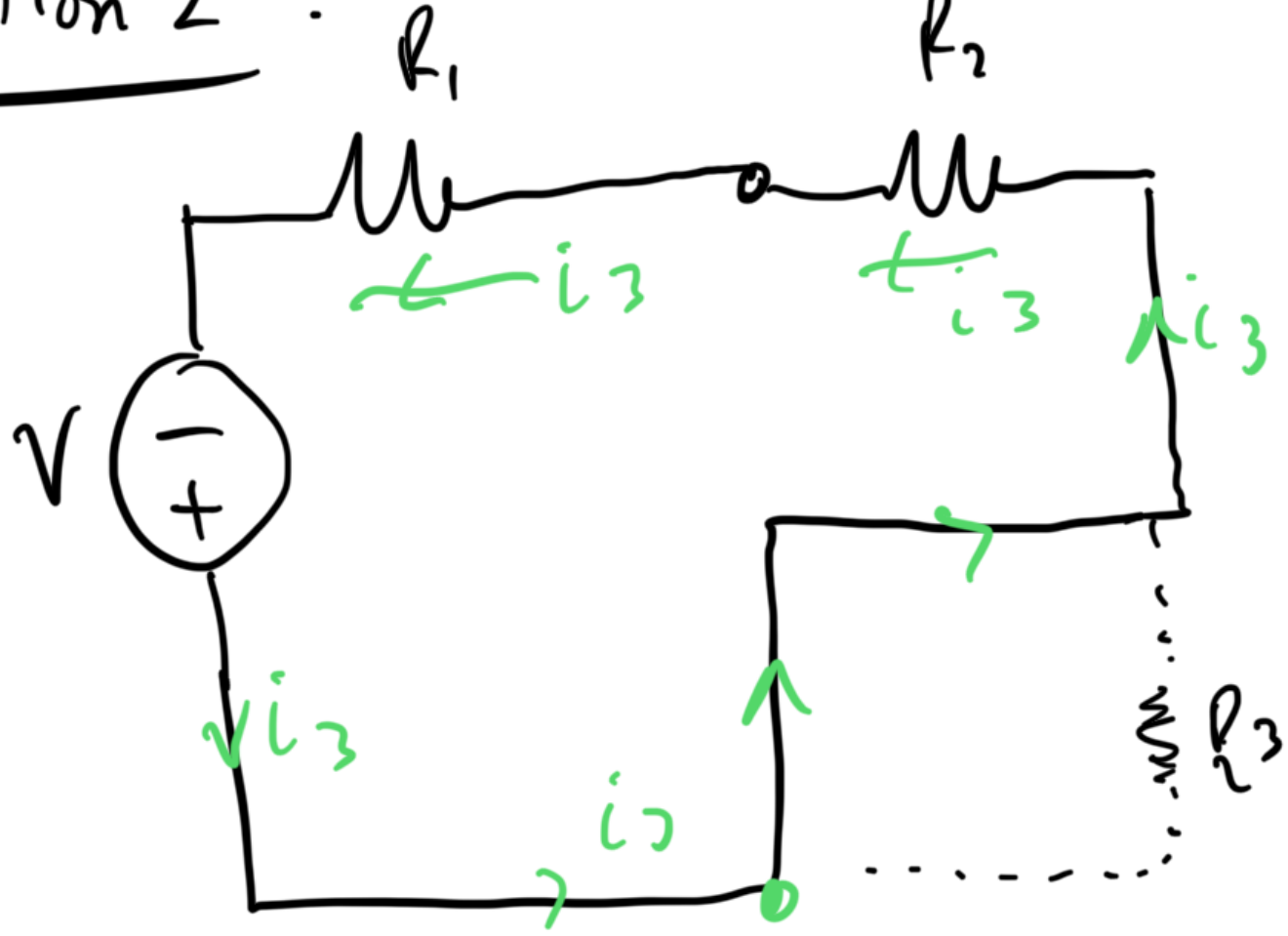
Position 1:



$$V - i_2 R_3 - \frac{i_2}{2} R_2 - i_2 R_1 = 0$$

$$i_2 = \frac{V}{R_1 + \frac{R_2}{2} + R_3}$$

Position 2 :



$$i_3 = \frac{V}{R_1 + R_2}$$

① $R_1 + R_2 + R_3 = V/i_1$

② $R_1 + \frac{1}{2}R_2 + R_3 = V/i_2$

③ $R_1 + R_2 = V/i_3$

$$\begin{pmatrix} 1 & 1 & 1 \\ 1 & \frac{1}{2} & 1 \\ 1 & 1 & 0 \end{pmatrix} \begin{pmatrix} R_1 \\ R_2 \\ R_3 \end{pmatrix} = \begin{pmatrix} V/i_1 \\ V/i_2 \\ V/i_3 \end{pmatrix}$$

$i_1 = 1\,mA$

$i_2 = 1.25\,mA$

$i_3 = 1.80\,mA$

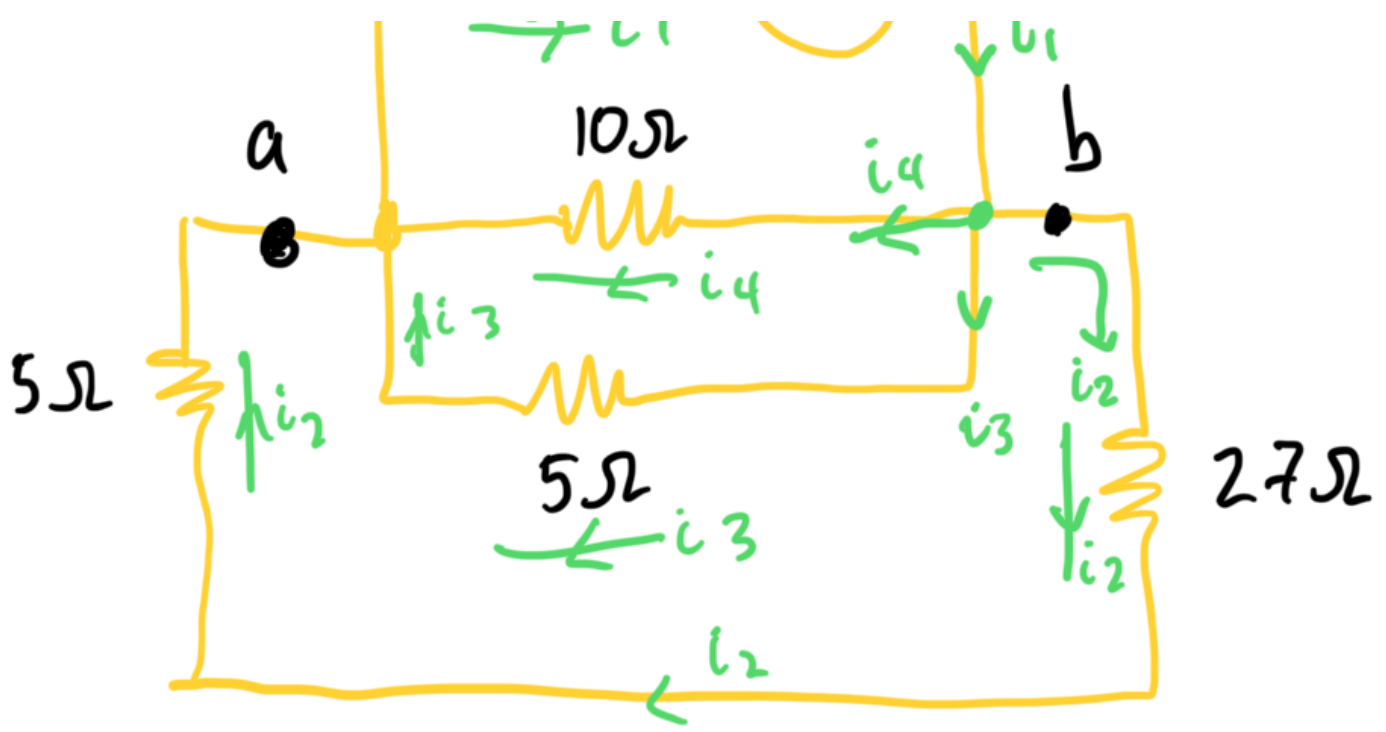
$$= \begin{pmatrix} 6000.00 \\ 4800.00 \\ 3333.33 \end{pmatrix}$$

$R_1 = 933.2\ \Omega$

$R_2 = 2400\ \Omega$

$R_3 = 2666.67\ \Omega$

8.



Junction: $i_1 = i_2 + i_3 + i_4$

Loop Rules:

Top → $25 - 10i_4 - 10i_1 = 0$

Middle → $-5i_3 + 10i_4 = 0$

Bottom → $-27i_2 - 5i_2 + 10i_4 = 0$

Solve:

$$\begin{pmatrix} 1 & -1 & -1 & -1 \\ 0 & 0 & -5 & 10 \\ -10 & 0 & 0 & -10 \\ 0 & -32 & 0 & 10 \end{pmatrix} \begin{pmatrix} i_1 \\ i_2 \\ i_3 \\ i_4 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ -25 \\ 0 \end{pmatrix}$$

$i_1 = 1.9203\ A$

$i_2 = 0.1812\ A$ ← current in 27 Ω resistor

$i_3 = 1.1594\ A$

$i_4 = 0.5797\ A$

$\Delta V = 32 i_4 = 5.80\ V$


AB