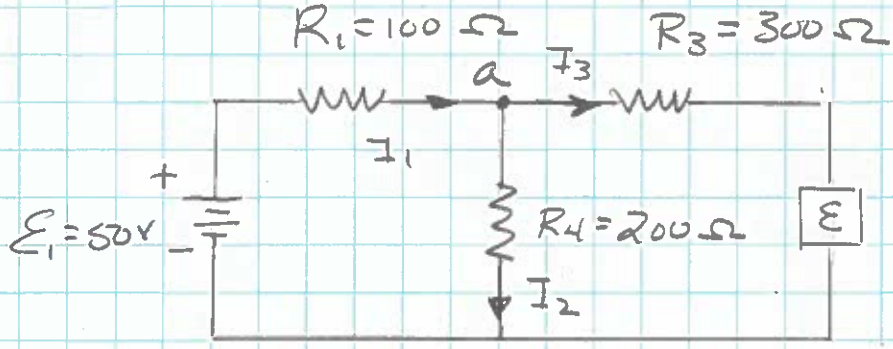

for R_4 to dissipate no power, must have $I_2 = 0$.

Junction at a: $I_1 = \cancel{I_2} + I_3 \Rightarrow I_1 = I_3$

Left loop ↻ from a: $-\cancel{I_2 R_2} + \mathcal{E}_1 - I_1 R_1 = 0$

So: $I_1 = \dfrac{\mathcal{E}_1}{R_1} = 0.5\,A = I_3$

Now, right loop ↻ from a: (Assume $\mathcal{E}$ has + on top and − on bottom)

$$-I_3 R_3 - \mathcal{E} + \cancel{I_2 R_2} = 0$$

$$\mathcal{E} = -I_3 R_3 = -150\,V$$

So, $\mathcal{E} = 150V$, but it is oriented with − on top and + on bottom.