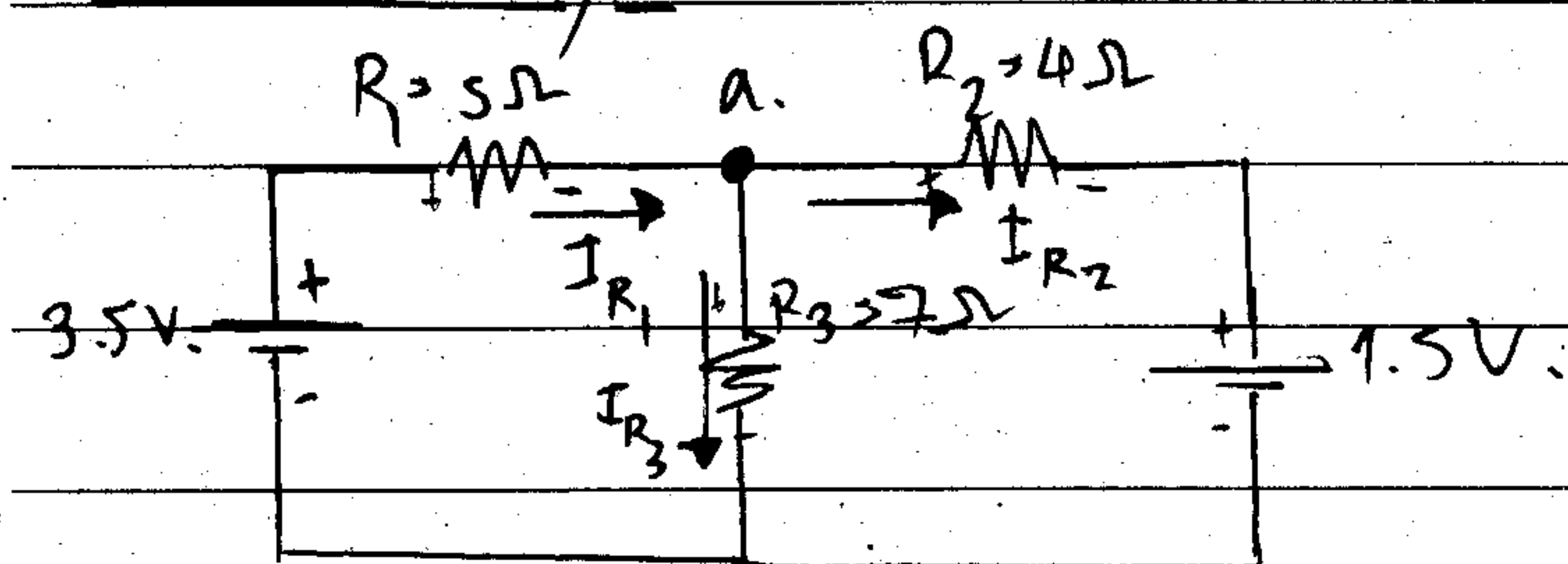


1. Node Analysis



Solⁿ nKCL

$$I_{R_1} - I_{R_2} - I_{R_3} = 0$$

$$\frac{3.5 - V_a}{5} - \frac{(V_a - 1.5)}{4} - \frac{V_a}{7} = 0$$

$$98 - 28V_a - (35V_a - 52.5) - 20V_a = 0$$

$$140$$

$$98 - 28V_a - 35V_a + 52.5 - 20V_a = 0$$

$$-83V_a + 150.5 = 0$$

$$(V_{R_3}) \rightarrow V_a = \frac{-150.5}{-83} = 1.813 \text{ V}$$

$$I_{R_1} = \frac{3.5 - 1.813}{5} = 0.337 \text{ A}$$

$$I_{R_2} = \frac{1.813 - 1.5}{4} = 0.078 \text{ A}$$

$$I_{R_3} = \frac{1.813}{7} = 0.259 \text{ A}$$

$$V_{R_1} = I_{R_1} R_1 = (0.337) \times (5) = 1.685 \text{ V}$$

$$V_{R_2} = I_{R_2} R_2 = (0.078) \times (4) = 0.312 \text{ V}$$

$$V_{R_3} = I_{R_3} R_3 = (0.259) \times (7) = 1.813 \text{ V}$$

$$P_{R_1} = I_{R_1} V_{R_1} = (0.337) (1.685) = 0.5678 \text{ W}$$

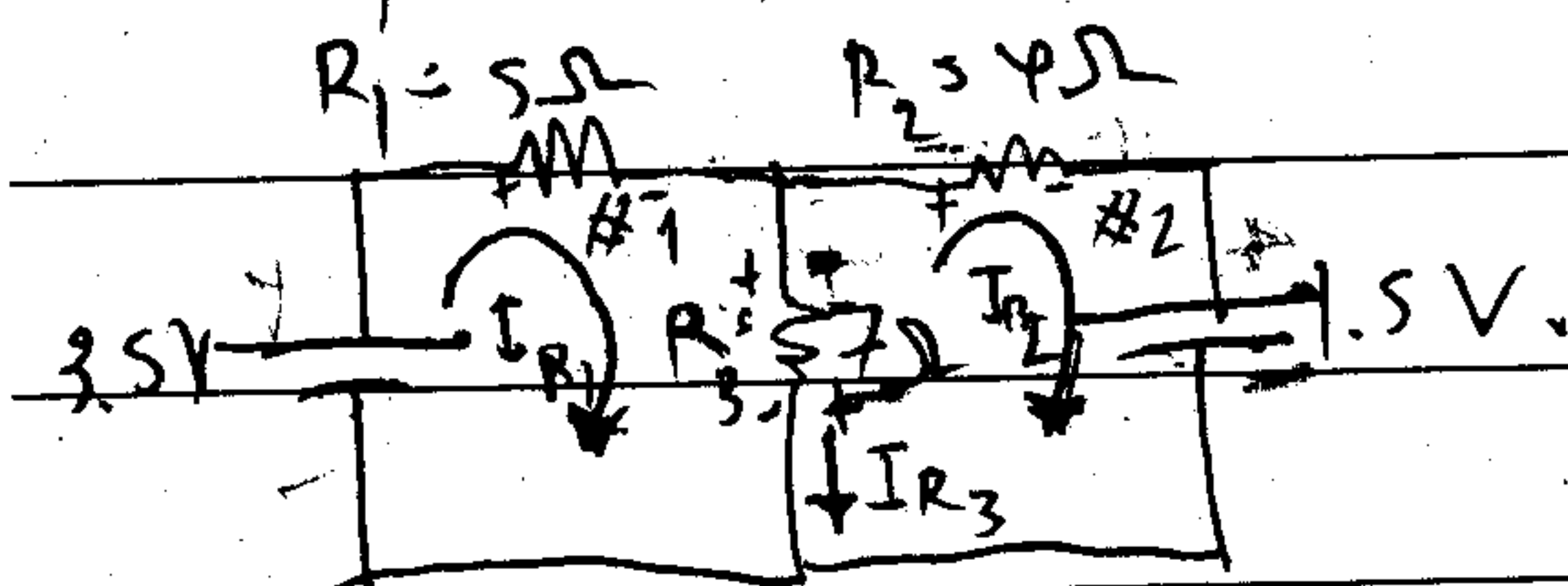
$$P_{R_2} = I_{R_2} V_{R_2} = (0.078) (0.312) = 0.0243 \text{ W}$$

$$P_{R_3} = (0.259) (1.813) = 0.4696 \text{ W}$$

$$P_{3.5V} = (3.5) (-0.337) = -1.18 \text{ W}$$

$$P_{1.5V} = (1.5) (0.078) = 0.117 \text{ W}$$

2 Loop Analysis



Solⁿ Loop * 1.

$$-3.5 + 12I_1 - 7I_2 = 0.$$

$$12I_1 - 7I_2 = 3.5 \quad \text{--- (1)}$$

Loop * 2.

$$1.5 - 7I_1 + 11I_2 = 0$$

$$-7I_1 + 11I_2 = -1.5 \quad \text{--- (2)}$$

$$I_{R_1} = \frac{\begin{vmatrix} 3.5 & -7 \\ -1.5 & 11 \end{vmatrix}}{\begin{vmatrix} 12 & -7 \\ -7 & 11 \end{vmatrix}} = \frac{38.5 - 10.5}{132 - 49} = \frac{28}{83} = 0.337 \text{ A} \quad \underline{\text{Ans}}$$

$$I_{R_2} = \frac{\begin{vmatrix} 12 & 3.5 \\ -7 & -1.5 \end{vmatrix}}{\begin{vmatrix} 12 & -7 \\ -7 & 11 \end{vmatrix}} = 0.078 \text{ A} \quad \underline{\text{Ans}}$$

$$I_{R_3} = I_{R_1} - I_{R_2} = 0.337 - 0.078 = 0.259 \text{ A} \quad \text{X}$$

$$V_{R_1} = I_{R_1} R_1 = (0.337)(5) = 1.685 \text{ V} \quad \text{X}$$

$$V_{R_2} = I_{R_2} R_2 = (0.078)(4) = 0.312 \text{ V} \quad \text{X}$$

$$V_{R_3} = I_{R_3} R_3 = (0.259)(7) = 1.813 \text{ V} \quad \text{X}$$

$$P_{R_1} = (0.337)(1.685) = 0.5678 \text{ W} \quad \text{X}$$

$$P_{R_2} = (0.078)(0.312) = 0.0243 \text{ W} \quad \text{X}$$

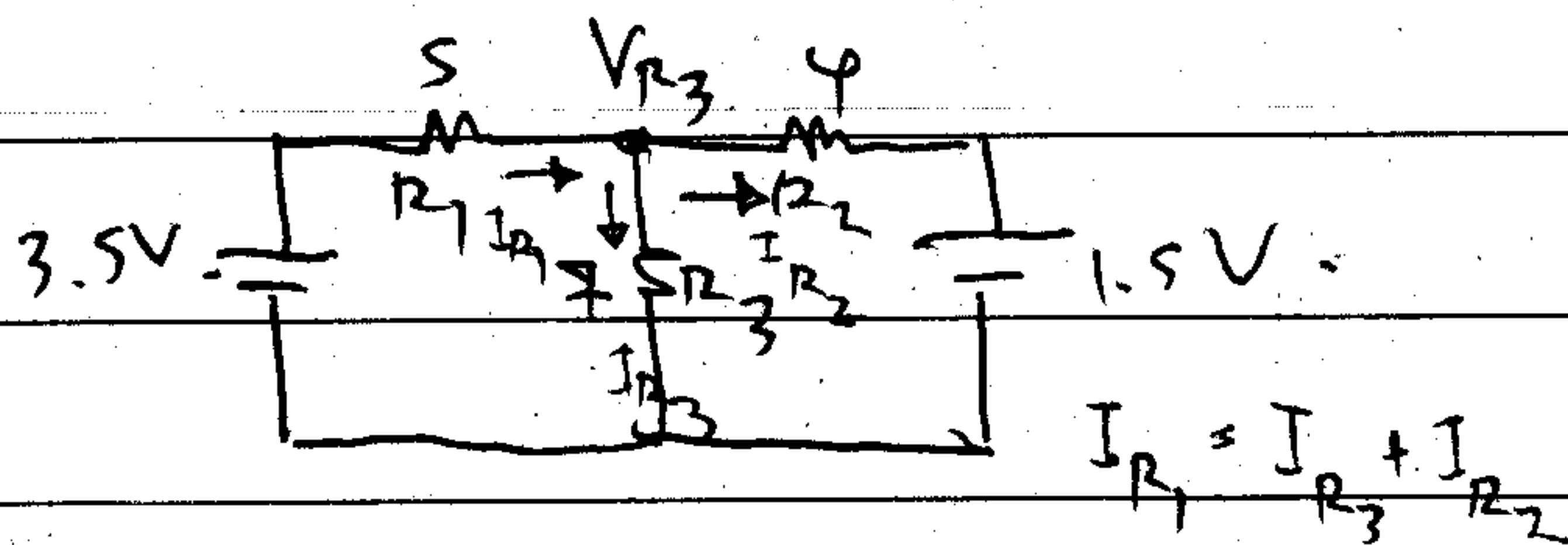
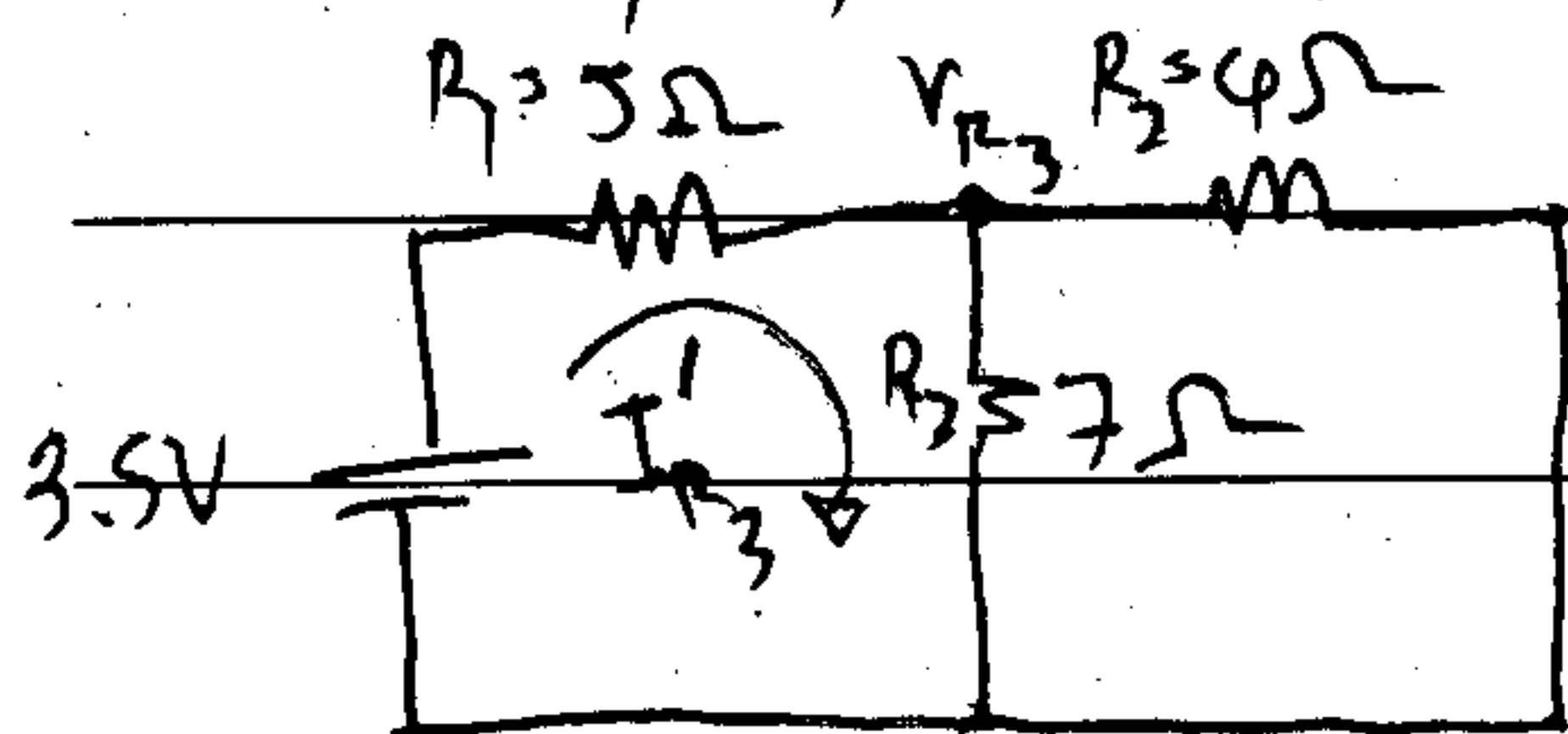
$$P_{R_3} = (0.259)(1.813) = 0.4696 \text{ W} \quad \text{X}$$

$$P_{3.5V} = (3.5)(-0.337) = -1.18 \text{ W} \quad \text{X}$$

$$P_{1.5V} = (1.5)(0.078) = 0.117 \text{ W} \quad \text{X}$$

$$= 0.117 \text{ W} \quad \text{X}$$

3. Superposition.

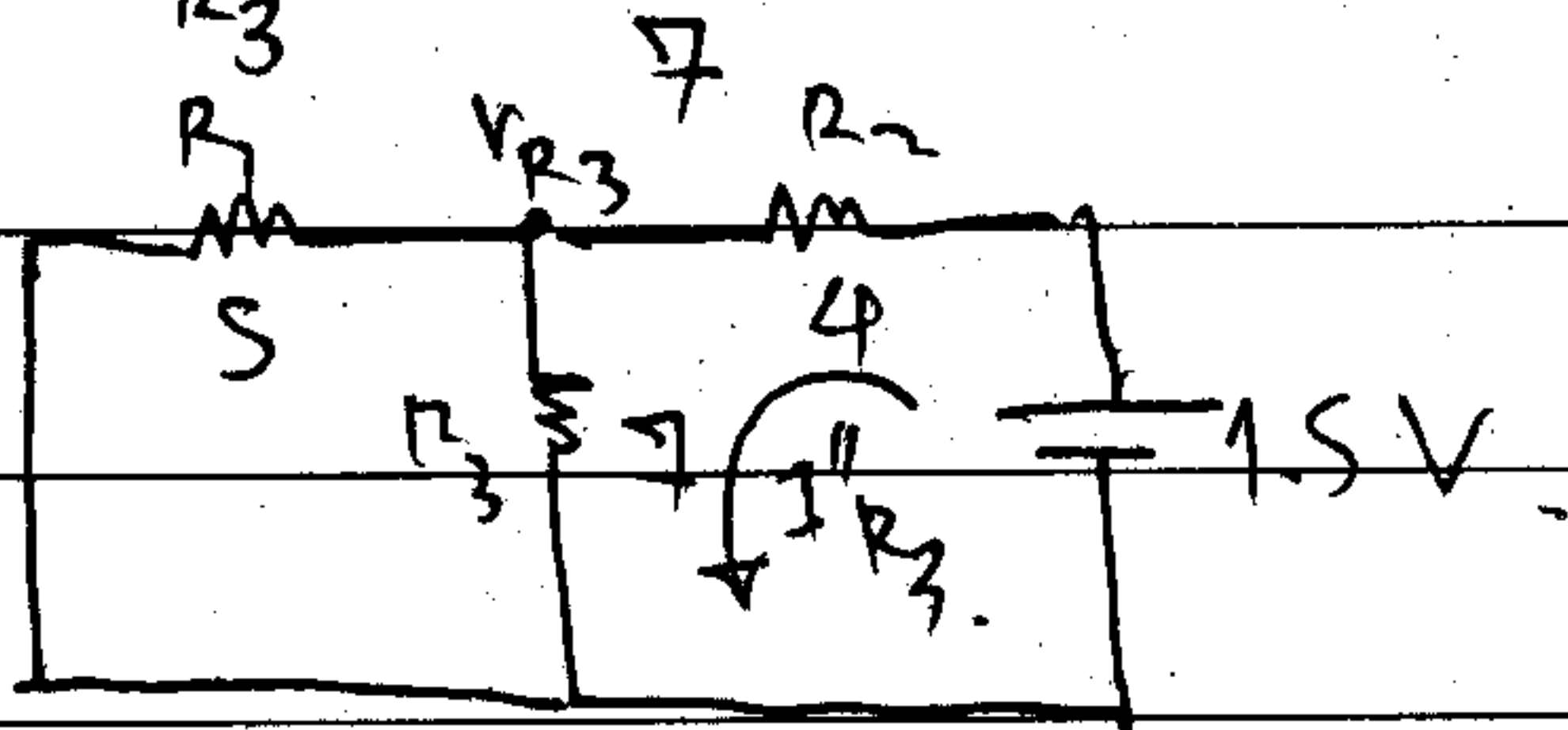


$$V'_{R3} = V \times \left(\frac{7 // 4}{5 + 7 // 4} \right)$$

$$= 3.5 \times \frac{2.55}{7.55}$$

$$= 1.182 \text{ V.}$$

$$I'_{R3} = \frac{1.182}{7} = 0.169 \text{ A.}$$



$$V''_{R3} = V \times \left(\frac{5 // 7}{4 + 5 // 7} \right)$$

$$= 1.5 \times \frac{2.917}{6.917} = 0.633 \text{ V.}$$

$$I''_{R3} = \frac{0.633}{7} = 0.09 \text{ A.}$$

$$I_{R3} = I'_{R3} + I''_{R3} = 0.169 \text{ A} + 0.09 \text{ A} = 0.259 \text{ A.}$$

$$V_{R3} = (0.259 \text{ A})(7\Omega) = 1.813 \text{ V.}$$

$$I_{R1} = \frac{3.5 - 1.813}{5} = 0.337 \text{ V.}$$

$$I_{R2} = \frac{1.813 - 1.5}{4} = 0.078 \text{ V.}$$

$$V_{R1} = (I_{R1})(R_1) = (0.337)(5) = 1.685 \text{ V.}$$

$$V_{R_2} = I_{R_2} R_2 = (0.078)(4) = 0.312 \text{ V. } \times \times$$

$$P = IV$$

$$P_{R_1} = (0.337)(1.685) = 0.5678 \text{ W. } \times$$

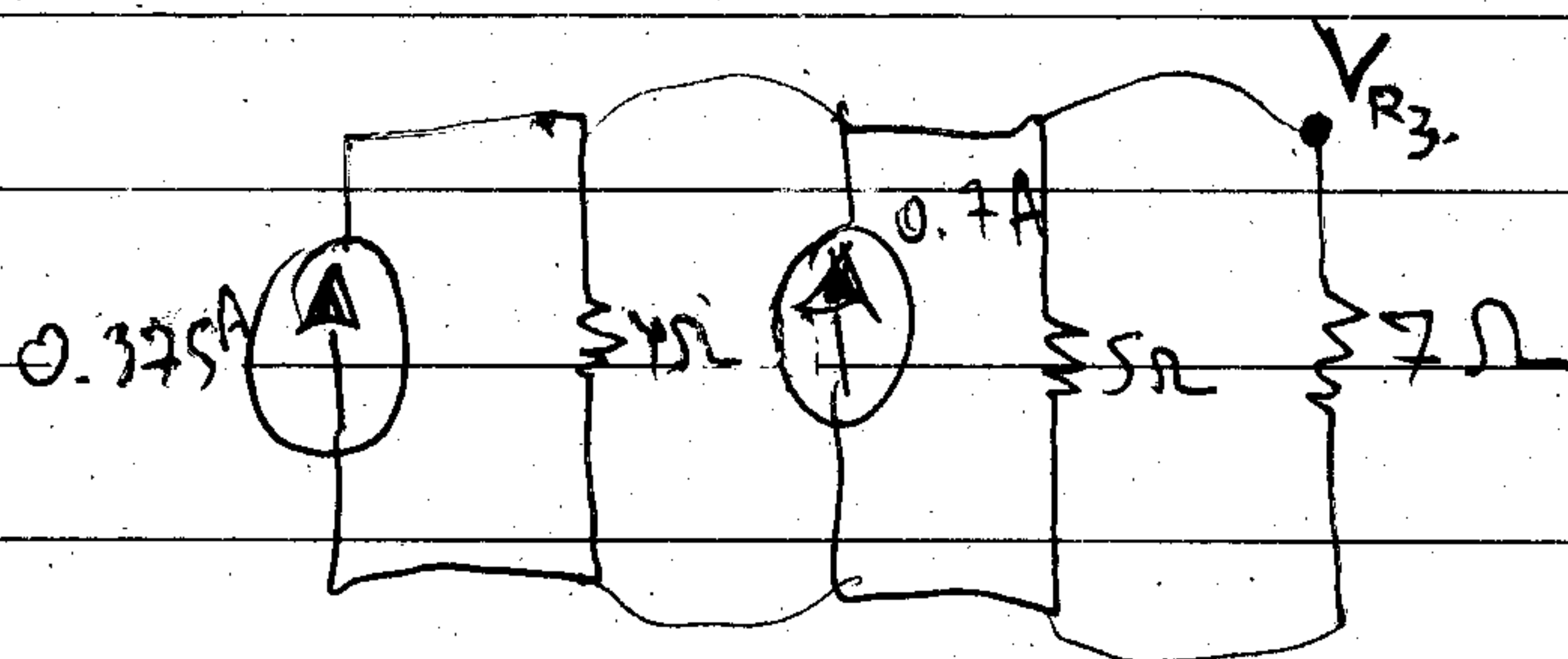
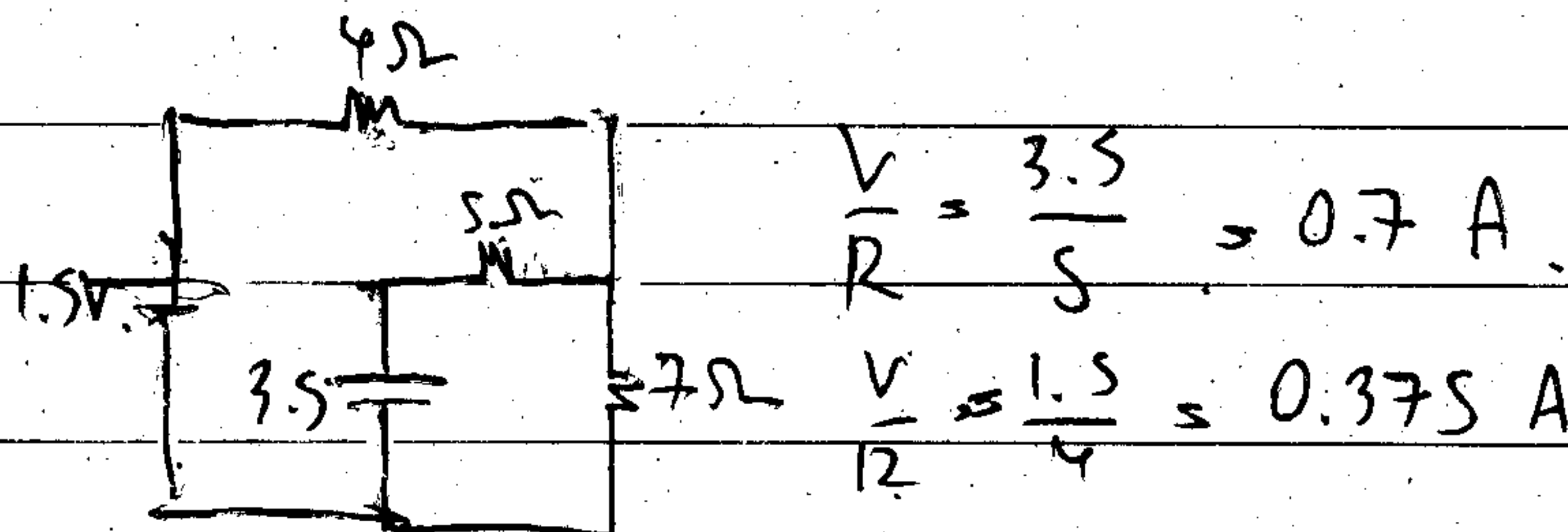
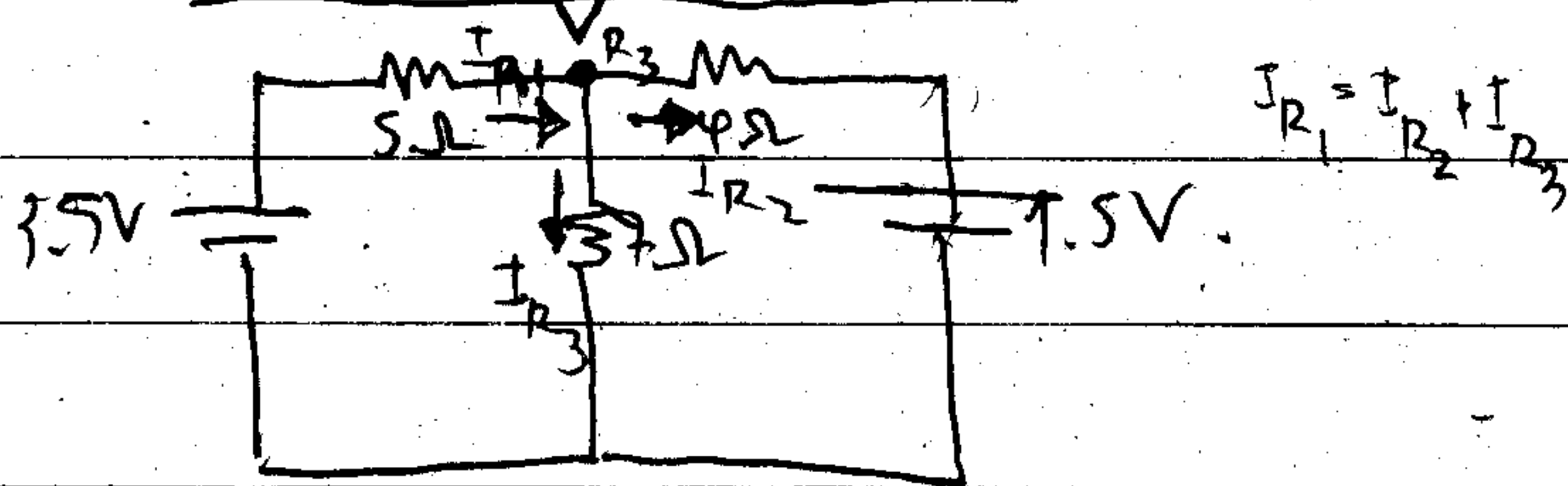
$$P_{R_2} = (0.078)(0.312) = 0.0243 \text{ W. } \times$$

$$P_{R_3} = (0.259)(1.813) = 0.4696 \text{ W. } \times$$

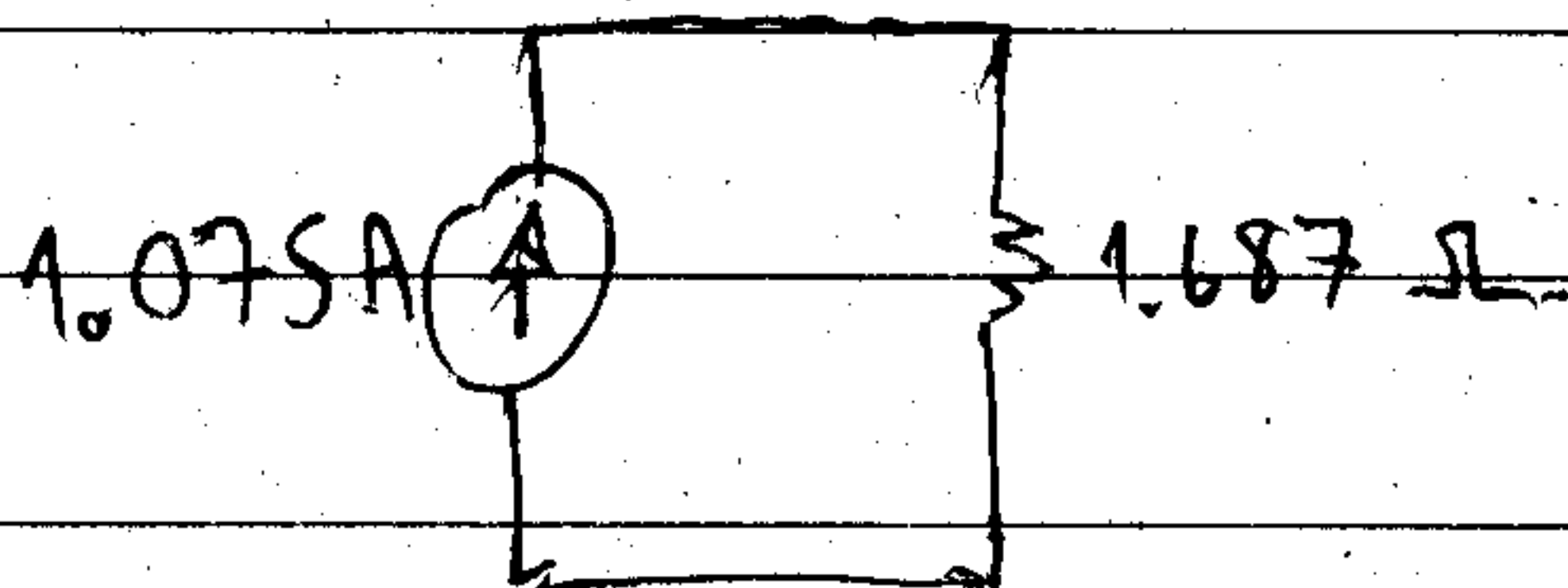
$$P_{3.5V} = (3.5)(-0.337) = -1.18 \text{ W. } \times$$

$$P_{1.5V} = (1.5)(0.078) = 0.117 \text{ W. } \times$$

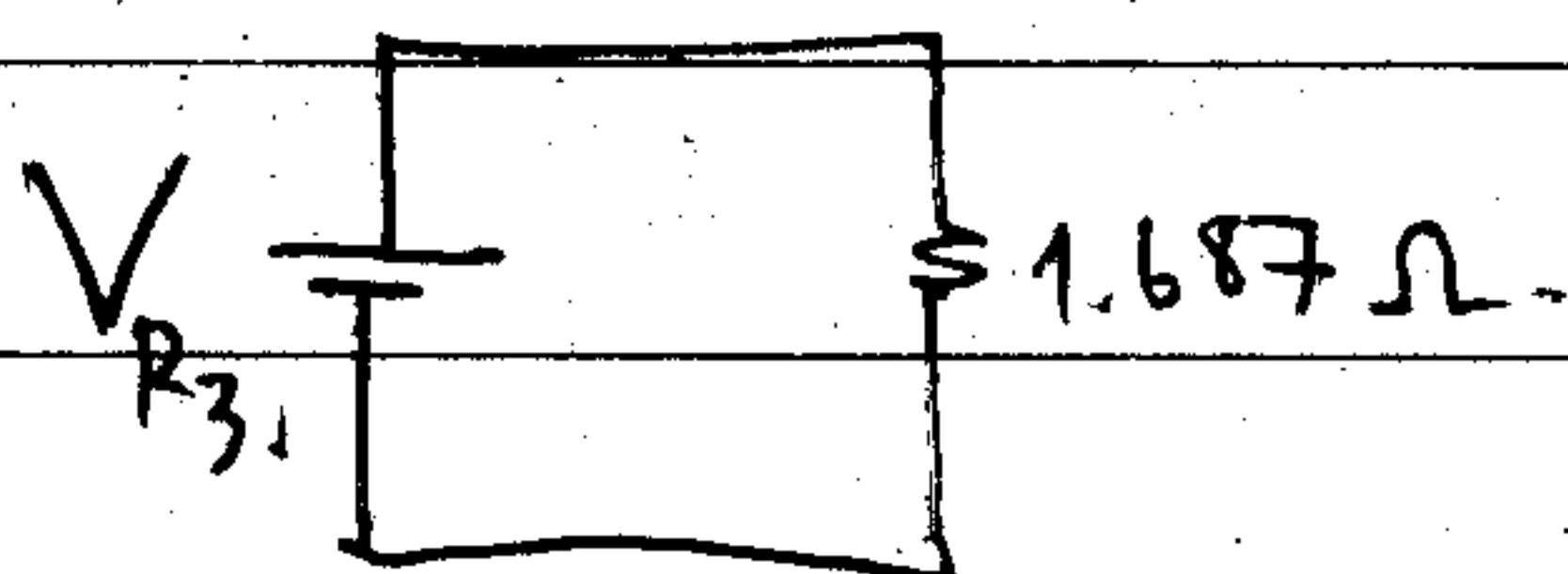
4 Source Transformation



$$4 \parallel 5 \parallel 7 = 1.687 \Omega$$



$$V_{R3} = IR = 1.075 \times 1.687 = 1.813 \text{ V}$$



$$I_{R3} = \frac{V_{R3}}{R_3} = \frac{1.813}{7} = 0.259 \text{ A}$$

$$I_{R1} = \frac{3.5 - 1.813}{5} = 0.337 \text{ A}$$

$$I_{R2} = \frac{1.813 - 1.5}{4} = 0.078 \text{ A}$$

$$V_{R1} = I_{R1} R_1 = (0.337)(5) = 1.685 \text{ V}$$

$$V_{R2} = I_{R2} R_2 = (0.078)(4) = 0.312 \text{ V}$$

abgeschlossen →

$$P_{R_1} = (0.337)(1.685) = 0.5678 \text{ W.}$$

$$P_{R_2} = (0.078)(0.312) = 0.0243 \text{ W.}$$

$$P_{R_3} = (0.259)(1.813) = 0.4696 \text{ W.}$$

$$P_{3.5V} = (3.5)(-0.337) = -1.18 \text{ W.}$$

$$P_{1.5V} = (1.5)(0.078) = 0.117 \text{ W.}$$