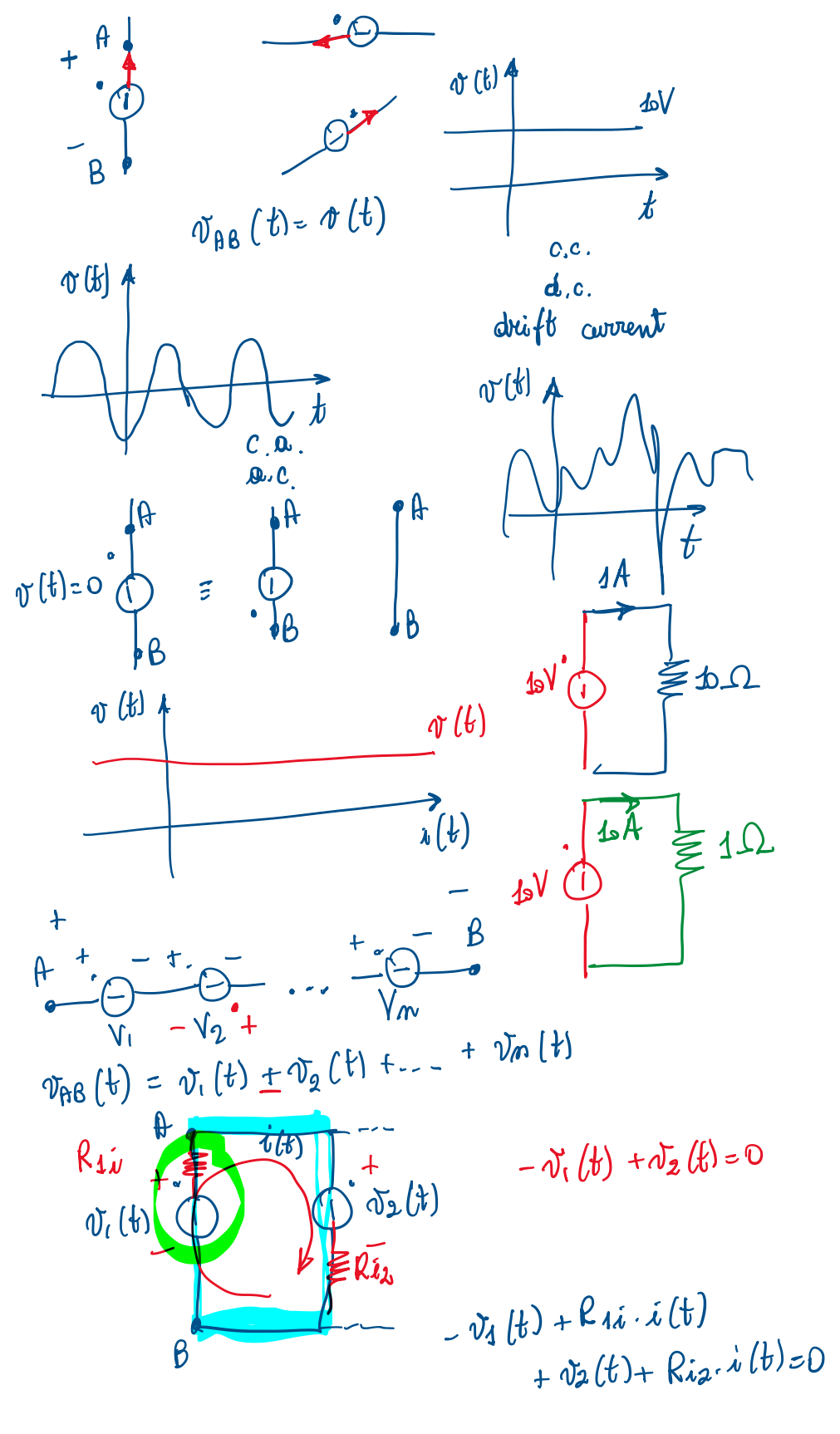
Lezioni 3-5

mercoledì 2 ottobre 2024 13:43

GENERATORE DI TENSIONE


A
B
+
−
c.c.
d.c.
drift current
C.A.
a.c.
1V
1Ω
R_{si}
R_{i2}

$v_{AB}(t) = v(t)$

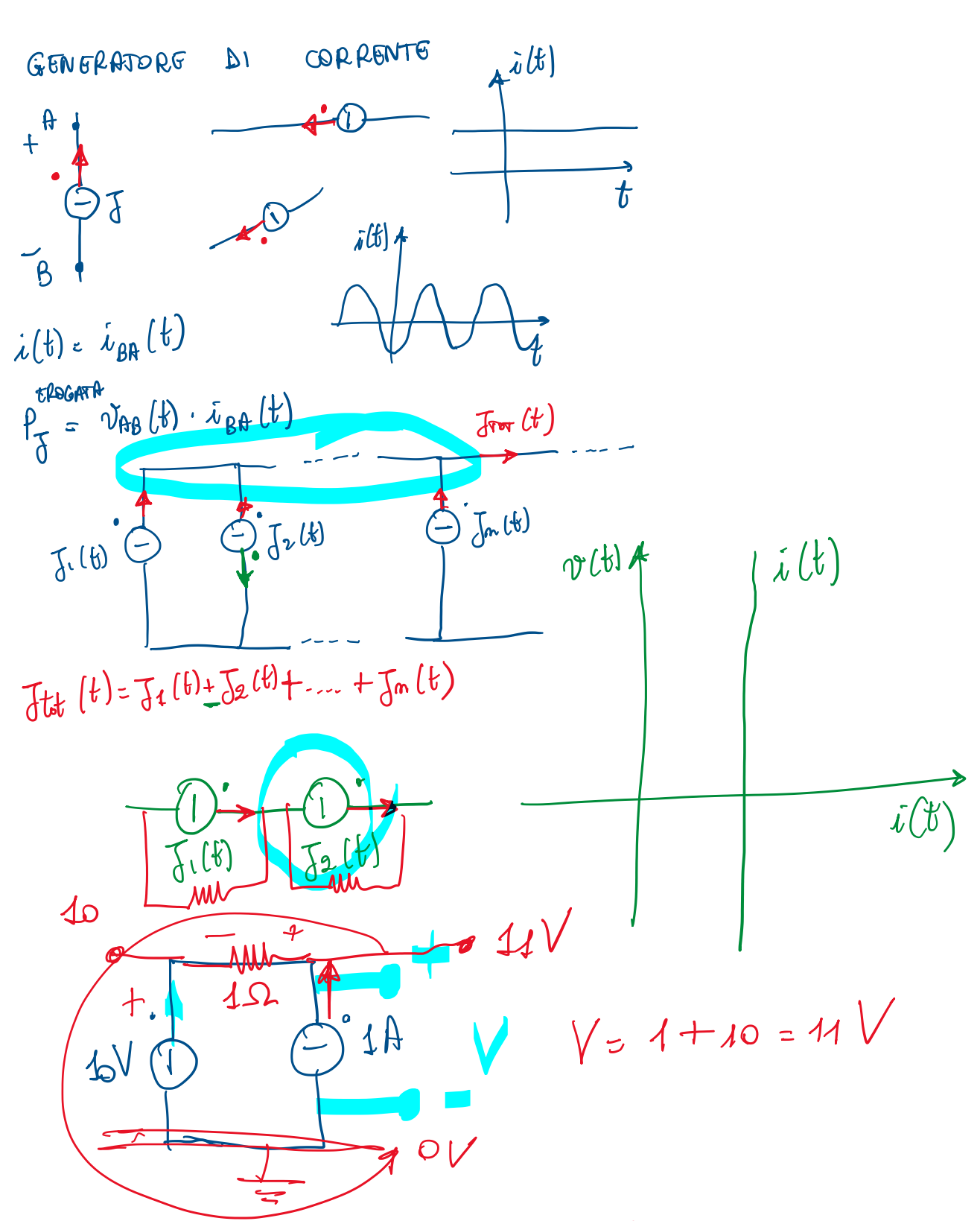
$v(t) = 0$

$v_{AB}(t) = v_1(t) \pm v_2(t) + \dots + v_n(t)$

$-v_1(t) + v_2(t) = 0$

$-v_1(t) + R_{si} \cdot i(t) + v_2(t) + R_{i2} \cdot i(t) = 0$

GENERATORE DI CORRENTE


A
B
J
$J_{tot}(t)$
$J_1(t)$
$J_2(t)$
$J_n(t)$
1Ω
1V
1A
11V
0V
10

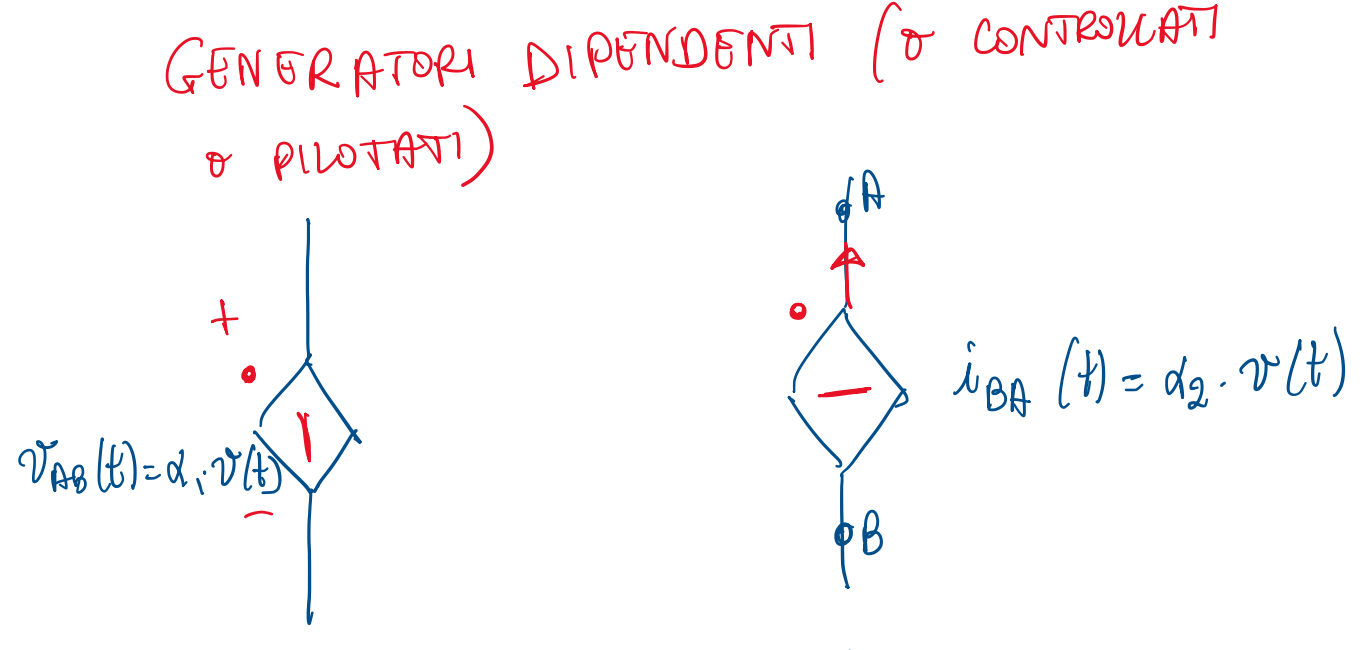
$i(t) = i_{BA}(t)$

$p_g = v_{AB}(t) \cdot i_{BA}(t)$

$J_{tot}(t) = J_1(t) + J_2(t) + \dots + J_n(t)$

$V = 1 + 10 = 11\,V$

GENERATORI DIPENDENTI (O CONTROLLATI O PILOTATI)



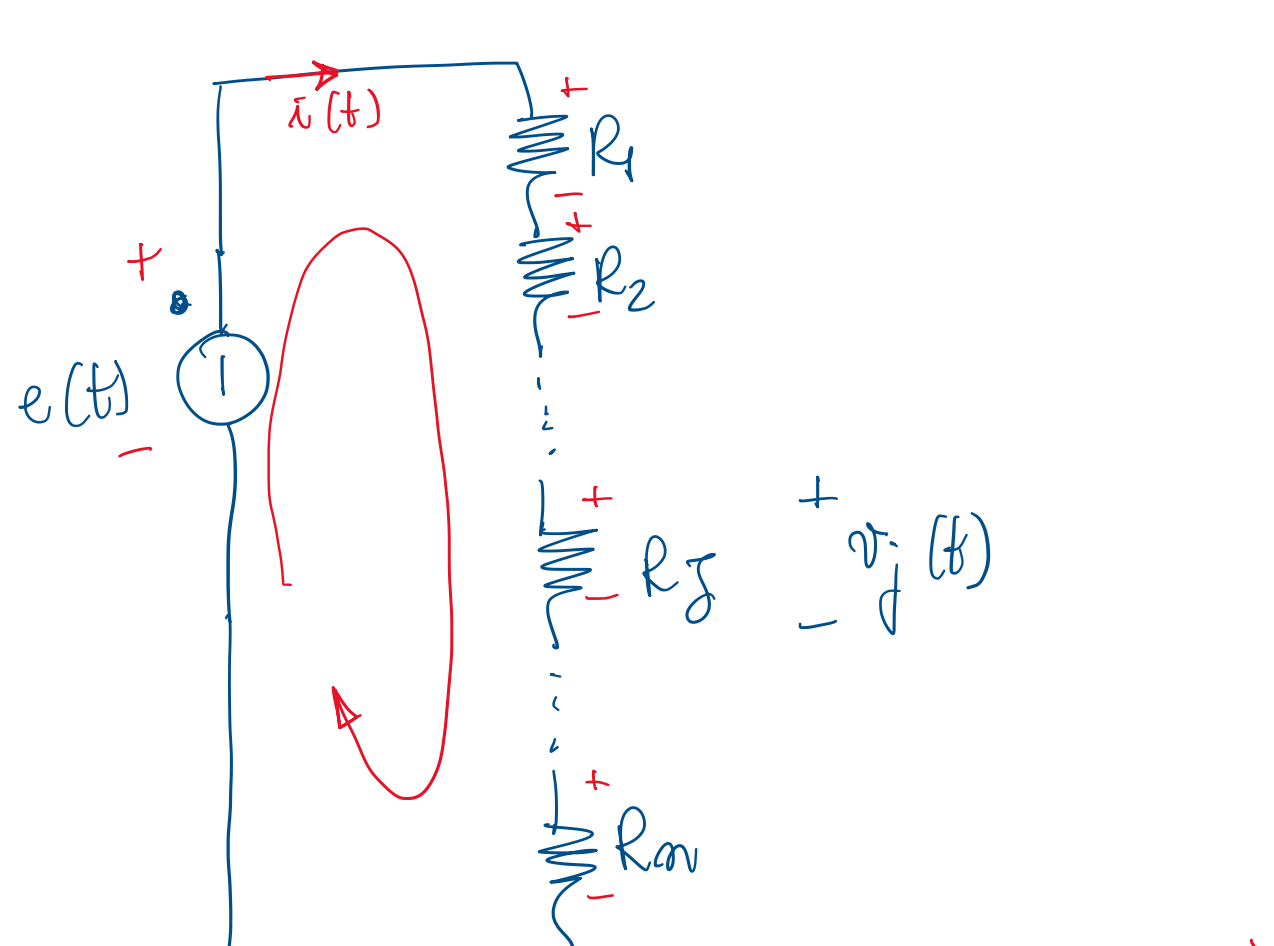
$v_{AB}(t) = \alpha_1 \cdot v(t)$

$i_{BA}(t) = \alpha_2 \cdot v(t)$

$v_{AB}(t) = \alpha_3 \cdot i(t)$

$i_{BA}(t) = \alpha_4 \cdot i(t)$

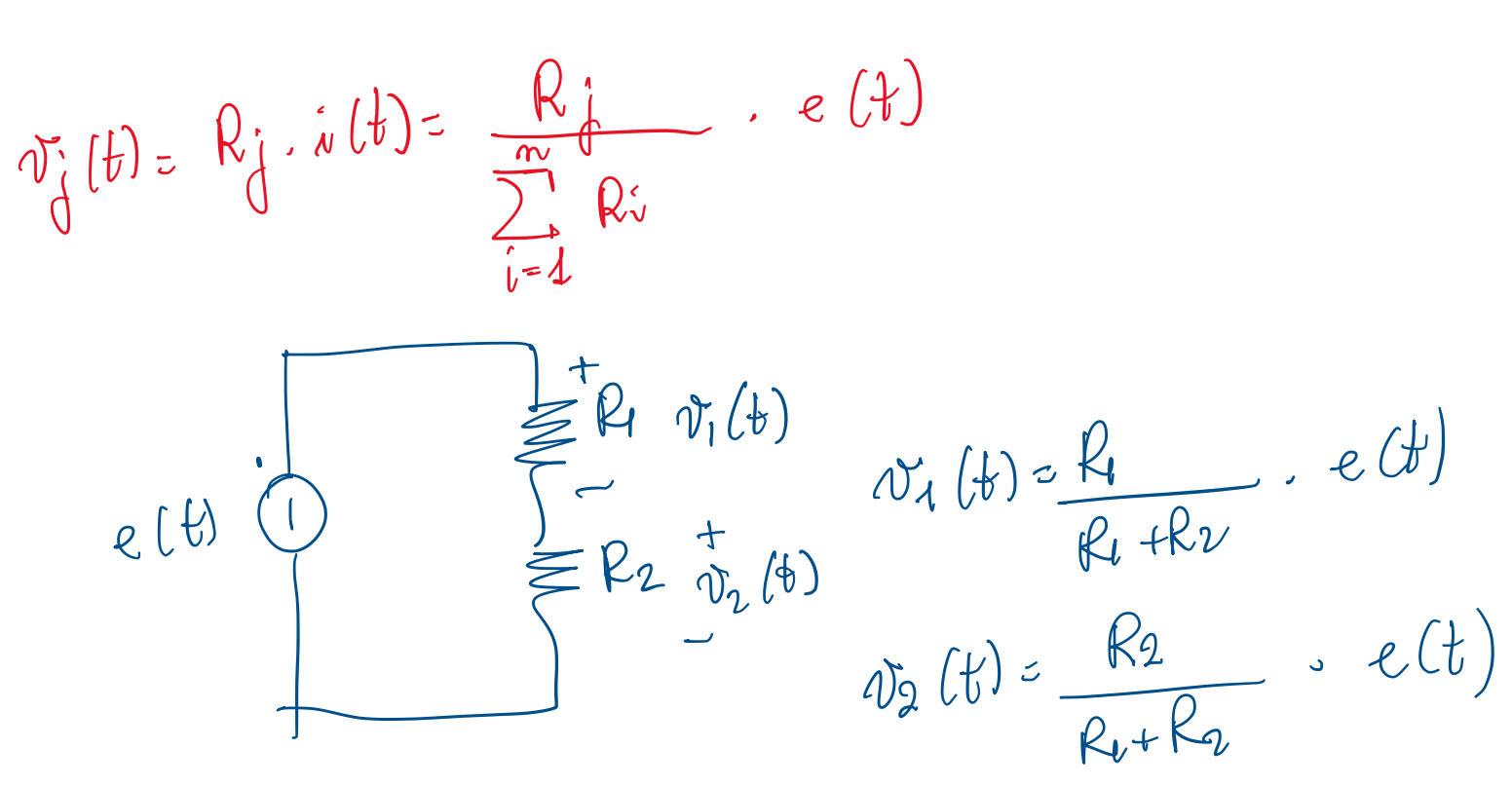
PARTITORE DI TENSIONE


$i(t)$
$e(t)$
R_1
R_2
R_j
R_n
$v_j(t)$

$-e(t) + R_1 \cdot i_1(t) + R_2 \cdot i_2(t) + \dots + R_N \cdot i_n(t) = 0$

$e(t) = i(t) \cdot \sum_{i=1}^{n} R_i \Rightarrow i(t) = \frac{e(t)}{\sum_{i=1}^{n} R_i}$

$v_j(t) = R_j \cdot i(t) = \frac{R_j}{\sum_{i=1}^{n} R_i} \cdot e(t)$



$v_1(t) = \frac{R_1}{R_1+R_2} \cdot e(t)$

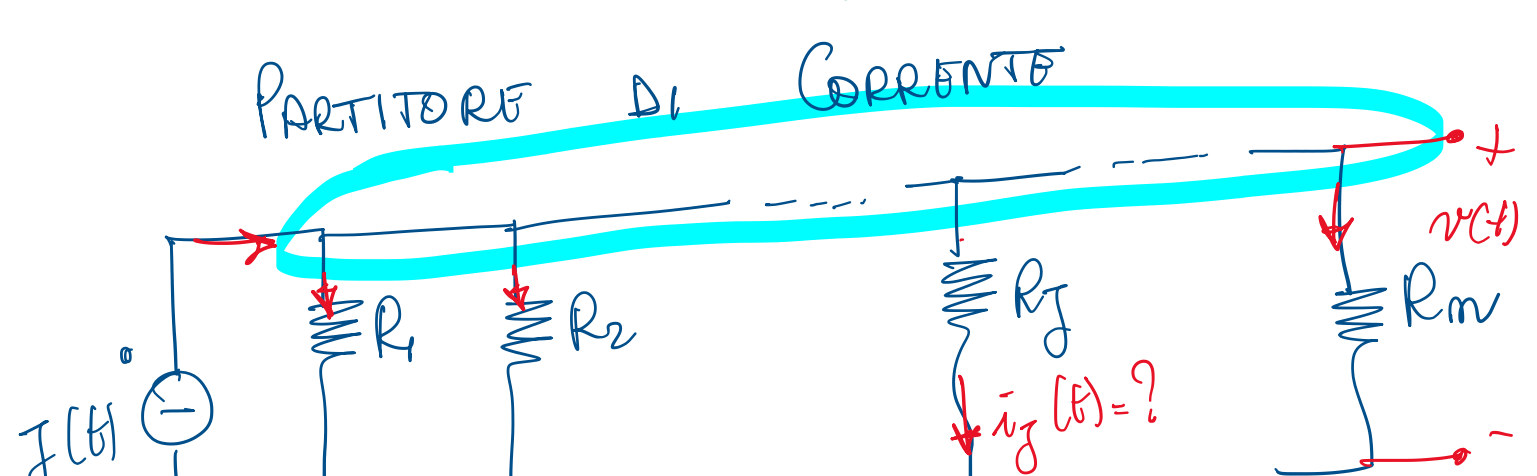
$v_2(t) = \frac{R_2}{R_1+R_2} \cdot e(t)$

$R_1 = R_2 = R$

$v_1(t) = \frac{R}{R+R} \cdot e(t) = \frac{e(t)}{2}$

$v_2(t) = \frac{e(t)}{2}$

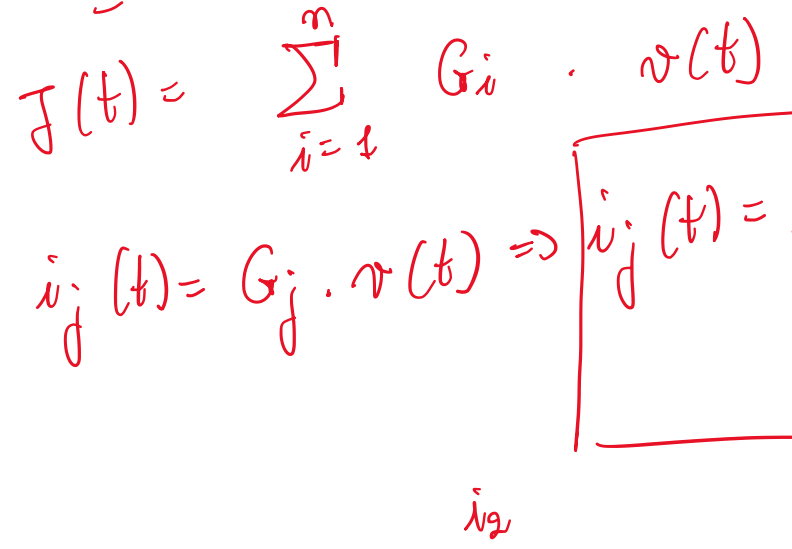
PARTITORE DI CORRENTE


$J(t)$
R_1
R_2
R_j
R_n
$i_j(t) = ?$
$v(t)$

$J(t) = J_1(t) + J_2(t) + \dots + J_n(t) = G_1 \cdot v(t) + G_2 \cdot v(t) + \dots + G_n \cdot v(t)$

$J(t) = \sum_{i=1}^{n} G_i \cdot v(t)$

$i_j(t) = G_j \cdot v(t) \Rightarrow \boxed{i_j(t) = \frac{G_j}{\sum_{i=1}^{n} G_i} \cdot J(t)}$


i_2
$i_1(t)$
$J(t)$
R_1
R_2

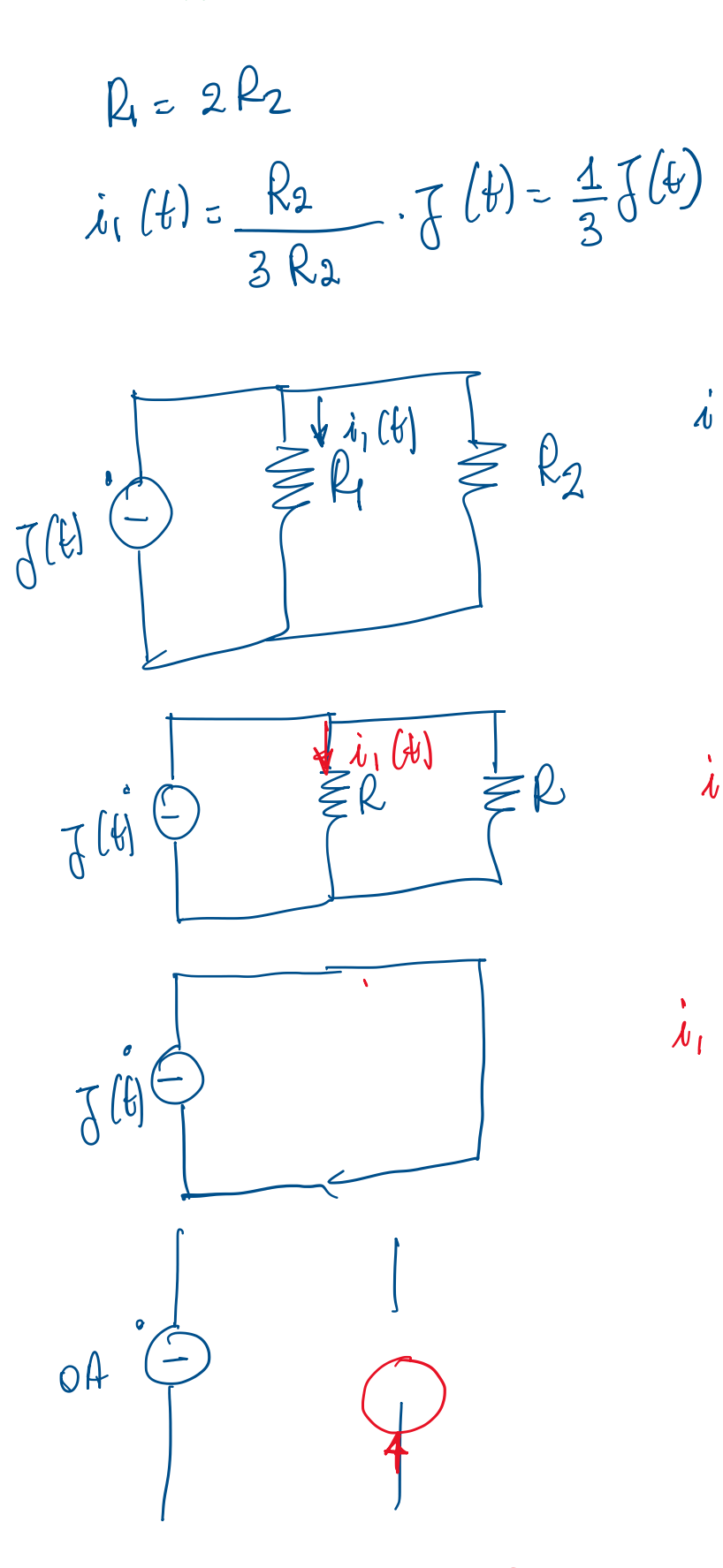
$i_1(t) = \frac{G_1}{G_1+G_2} \cdot J(t) = \frac{\frac{1}{R_1}}{\frac{1}{R_1}+\frac{1}{R_2}} \cdot J(t) = \frac{R_2}{R_1+R_2} \cdot J(t)$

$i_2(t) = \frac{G_2}{G_1+G_2} \cdot J(t) = \frac{\frac{1}{R_2}}{\frac{1}{R_1}+\frac{1}{R_2}} \cdot J(t) = \frac{R_1}{R_1+R_2} \cdot J(t)$

$R_1 = 2R_2$

$i_1(t) = \frac{R_2}{3R_2} \cdot J(t) = \frac{1}{3} J(t)$

$\frac{2R_2}{3R_2} J(t) = \frac{2}{3} J(t)$

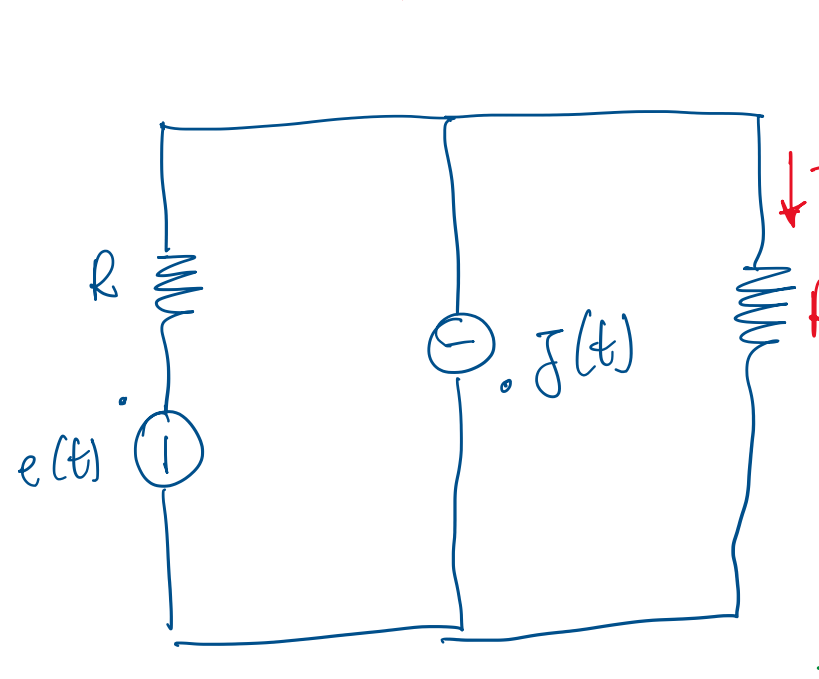

$J(t)$
$i_1(t)$
R_1
R_2
R
0A

$i_1(t) = J(t) \cdot \frac{R_2}{R_1+R_2}$

$i_1(t) = J(t) \cdot \frac{R}{2R} = \frac{J(t)}{2}$

$i_1(t) = J(t) \cdot \frac{0}{R} = 0$

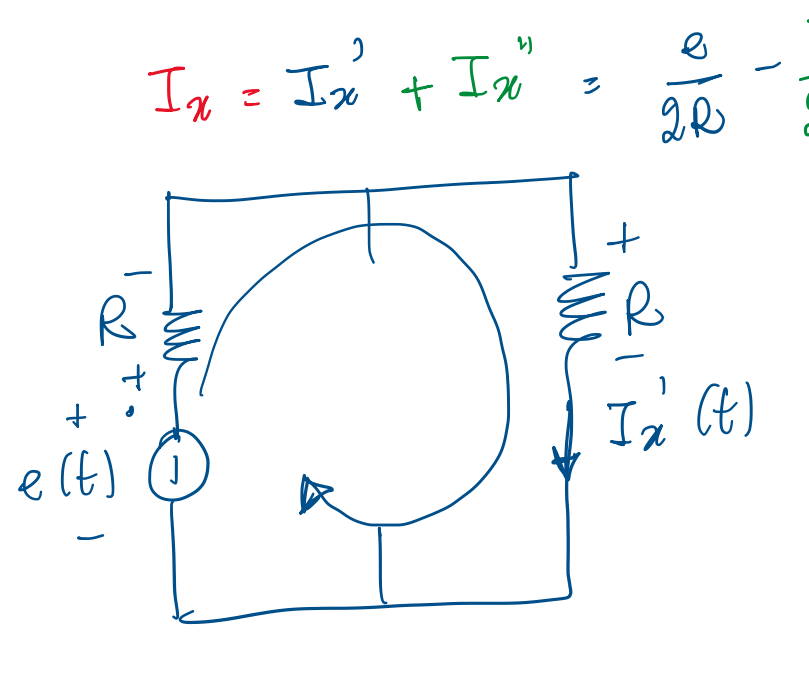
PRINCIPIO DI SOVRAPPOSIZIONE DEGLI EFFETTI



$P_R = ?$

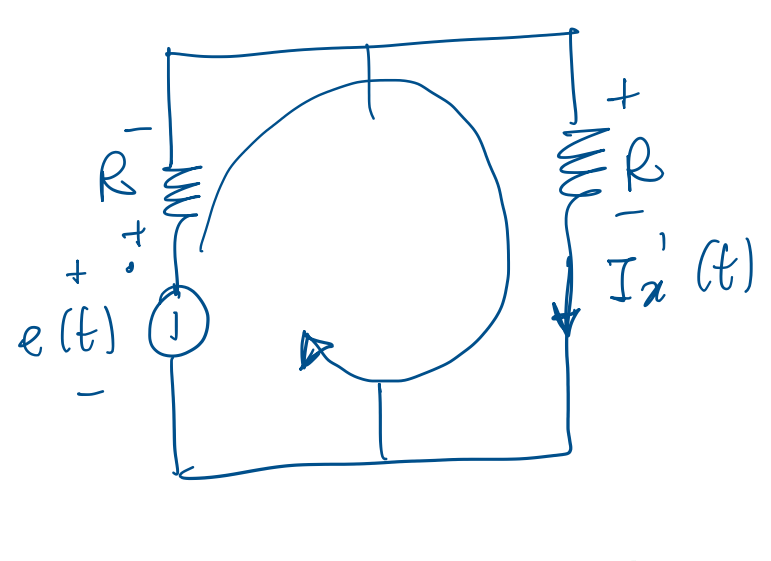
$P_R = R I_x^2$

$I_x = I_x' + I_x'' = \frac{e}{2R} - \frac{J}{2}$



$-e(t) + R I_x'(t) + R I_x'(t) = 0$

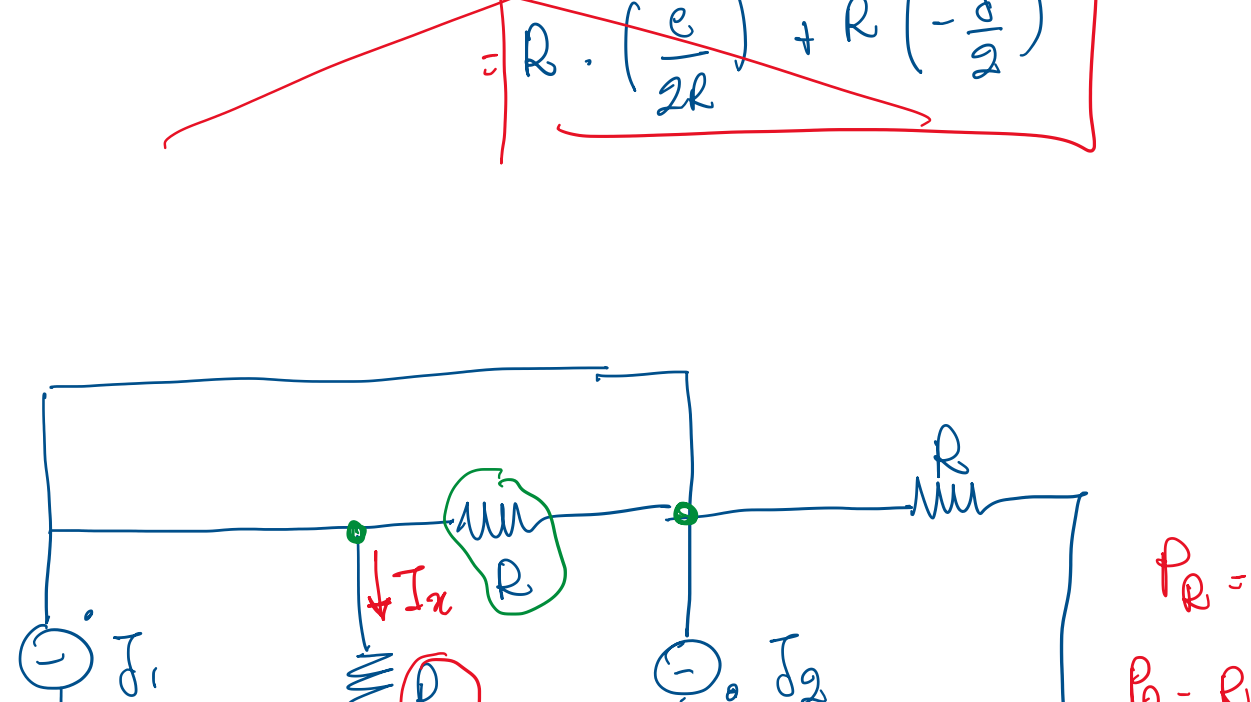
$I_x'(t) = \frac{e(t)}{2R}$



$I_x''(t) = -\frac{J(t)}{2}$

$\boxed{P_R = R\left(\frac{e}{2R} - \frac{J}{2}\right)^2}$

$\cancel{P_R = P_R' + P_R'' = R I_R'^2 + R I_R''^2 = R \cdot \left(\frac{e}{2R}\right)^2 + R\left(-\frac{J}{2}\right)^2}$



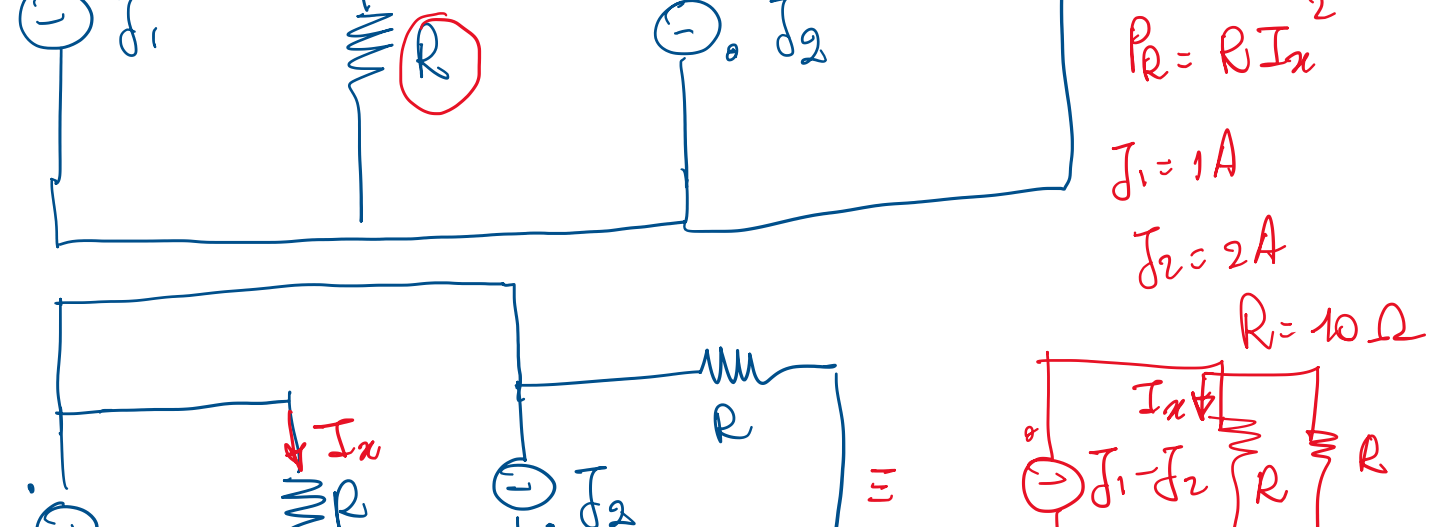
$P_R = ?$

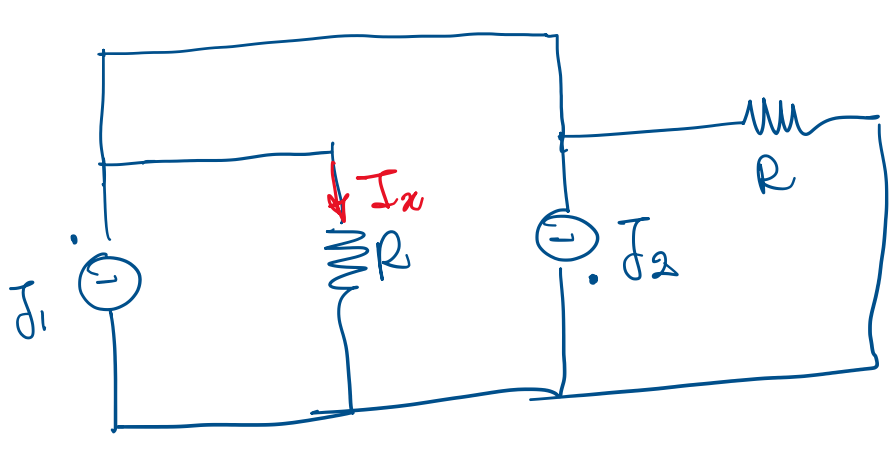
$P_R = R I_x^2$

$J_1 = 1A$

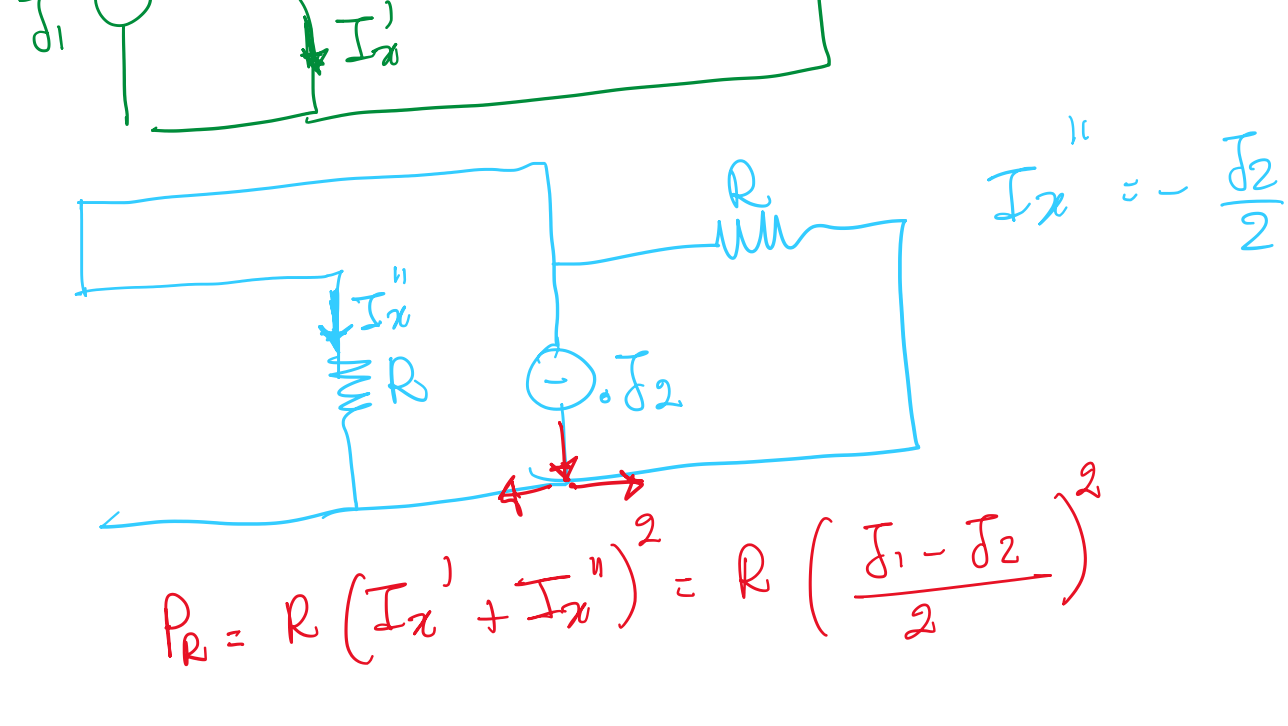
$J_2 = 2A$

$R = 10\,\Omega$


J_1
J_2
I_x
R
=
$J_1 - J_2$

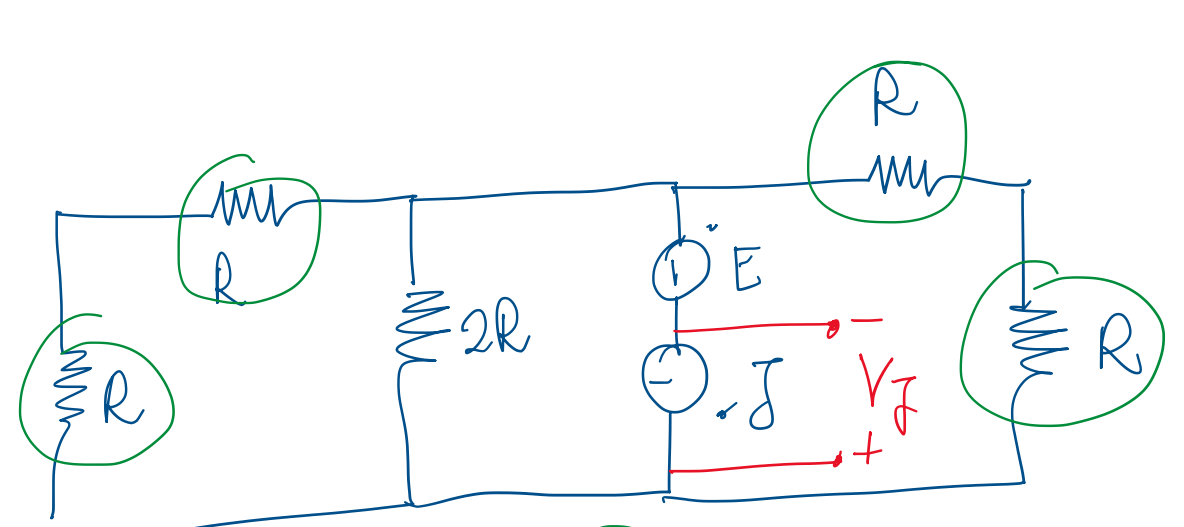


$\frac{J_1}{2} = I_x'$



$I_x'' = -\frac{J_2}{2}$

$P_R = R(I_x' + I_x'')^2 = R\left(\frac{J_1 - J_2}{2}\right)^2$

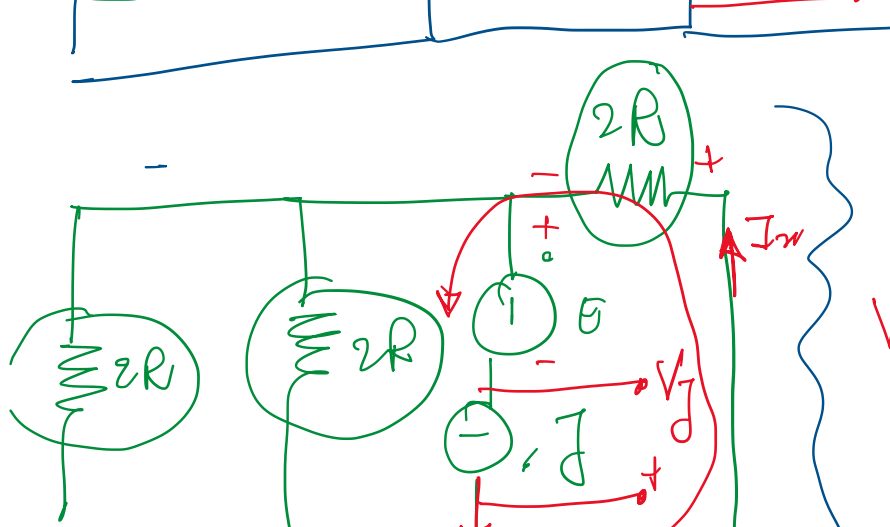


$E = 25V$

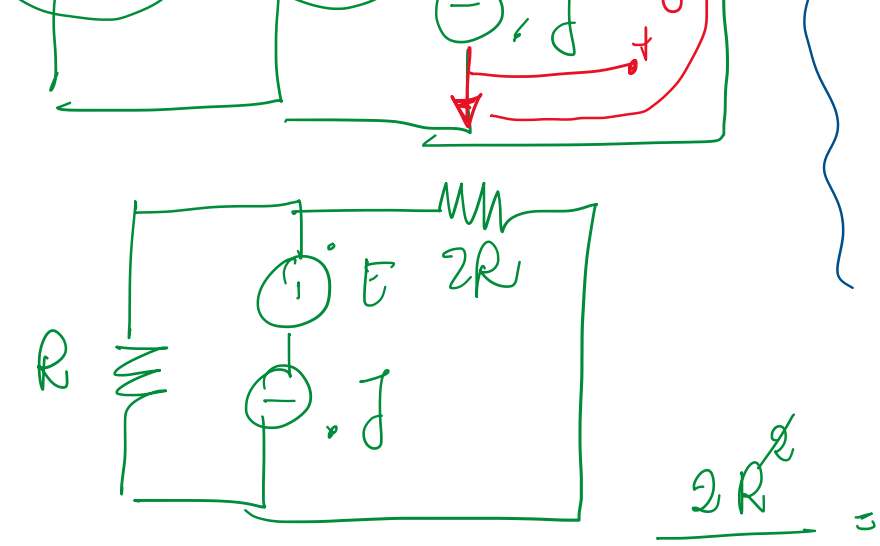
$J = 1A$

$R = 10\,\Omega$

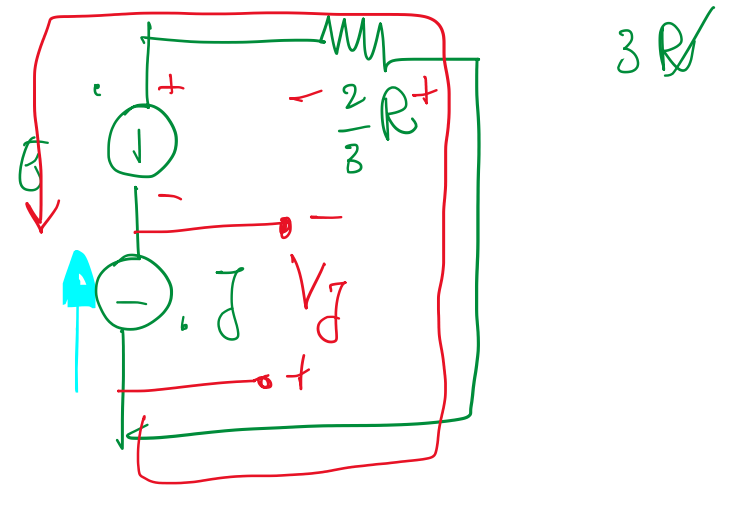
$P_J = ?$



$V_J = 2RI_x + E = 2R \cdot \frac{J}{3} + E$



$\frac{2R^{\cancel{2}}}{3\cancel{R}} = \frac{2}{3}R$

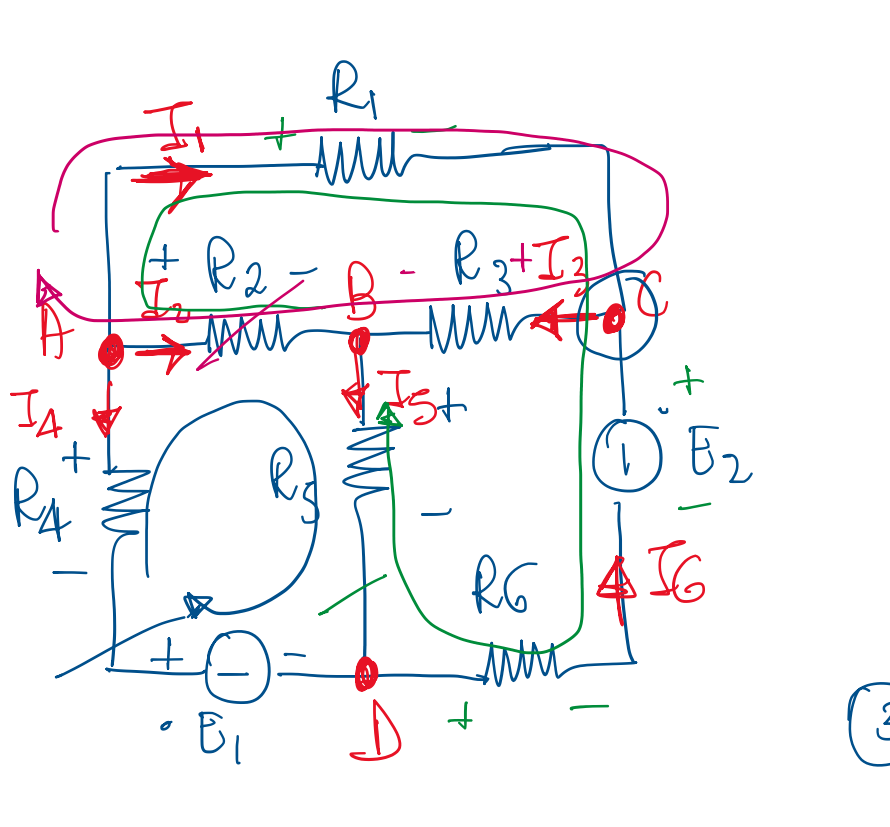

E
$\frac{2}{3}R$
J
V_J

$V_J = \frac{2}{3} RJ + E$

$P_J = V_J \cdot J$

METODO DELLE CORRENTI DI RAMO (O TABLEAU)

(METODO GENERALE)


I_1
R_1
R_2
I_2
B
R_3
I_3
C
A
I_4
R_4
I_5
E_2
R_6
I_6
E_1
D

r incognite − N_{g_c}

① Dare un nome ai nodi

② Dare un nome a tutte le correnti di ramo

③ Scrivere n−1 eq. a n−1 nodi con I° K.

④ Scrivere r − (n−1) eq. con il II° K.
$r - N_{g_c} - (n-1)$

A: $I_1 + I_2 + I_4 = 0$

B: $I_2 + I_3 = I_5$

C: $I_1 + I_6 = I_3$

$-E_1 - R_4 I_4 + R_2 I_2 + R_5 I_5 = 0$

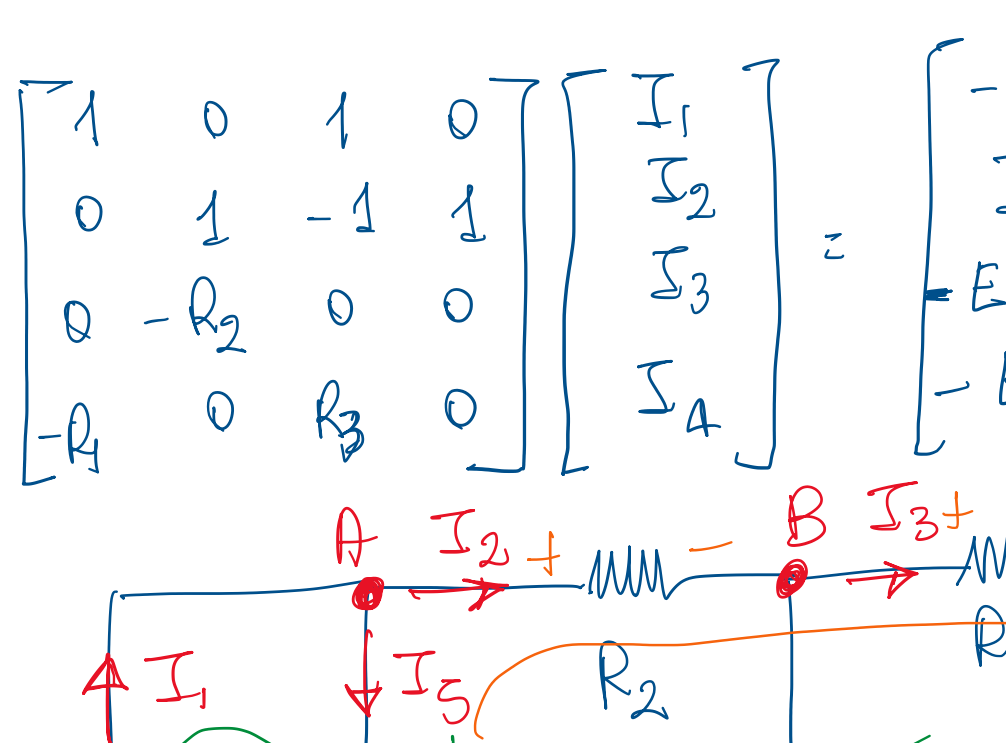
$-R_5 I_5 - R_2 I_2 + R_1 I_1 + E_2 - R_6 I_6 = 0$

$R_1 I_1 + R_3 I_3 - R_2 I_2 = 0$

$Ax = b \Rightarrow x = A^{-1} b$

$$\underbrace{\begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & -1 & 0 \\ 1 & 0 & -1 & 0 & 0 & 1 \\ 0 & R_2 & 0 & -R_4 & R_5 & 0 \\ R_1 & -R_2 & 0 & 0 & -R_5 & -R_6 \\ R_1 & -R_2 & R_3 & 0 & 0 & 0 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \\ I_6 \end{bmatrix}}_{x} = \underbrace{\begin{bmatrix} 0 \\ 0 \\ 0 \\ E_1 \\ -E_2 \\ 0 \end{bmatrix}}_{b} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ E_1 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ -E_2 \\ 0 \end{bmatrix}$$

$x = A^{-1} b_1 + A^{-1} b_2 = x' + x''$


I_3
R_3
I_5
V_I
I
A
B
D
I_1
I_2
I_4
R_1
R_2
E
C

A: $I + I_1 + I_3 = 0$

B: $I + I_3 = I_2 + I_4$

$\cancel{R_2 I_2 - R_1 I_1 = 0}$

$\cancel{R_2 I_2 - R_1 I_1 - I = 0}$

$R_2 I_2 - R_1 I_1, V_I = 0$

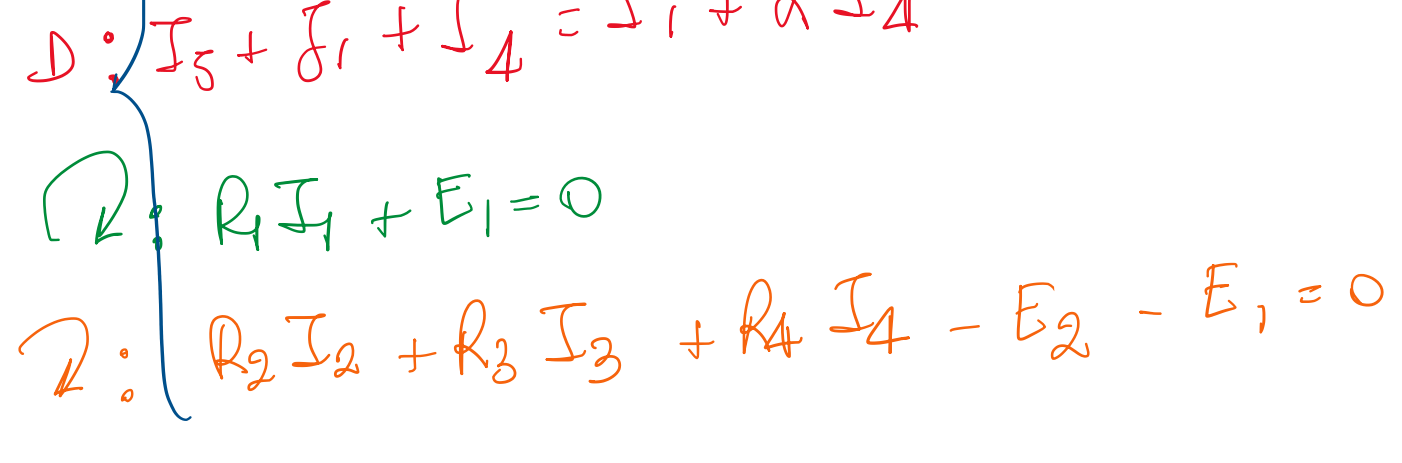
$I_5 = I - I_2$

$I = I_2 + I_5$

$-R_2 I_2 + E = 0$

$-R_1 I_1 + R_3 I_3 + E = 0$

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & -1 & 1 \\ 0 & -R_2 & 0 & 0 \\ -R_1 & 0 & R_3 & 0 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} -I \\ I \\ -E \\ -E \end{bmatrix}$$


A
I_2
B
I_3
C
I_4
I_1
I_5
R_2
R_3
R_4
R_1
E_1
J_1
αI_4
E_2
D

A: $I_1 = I_2 + I_5$

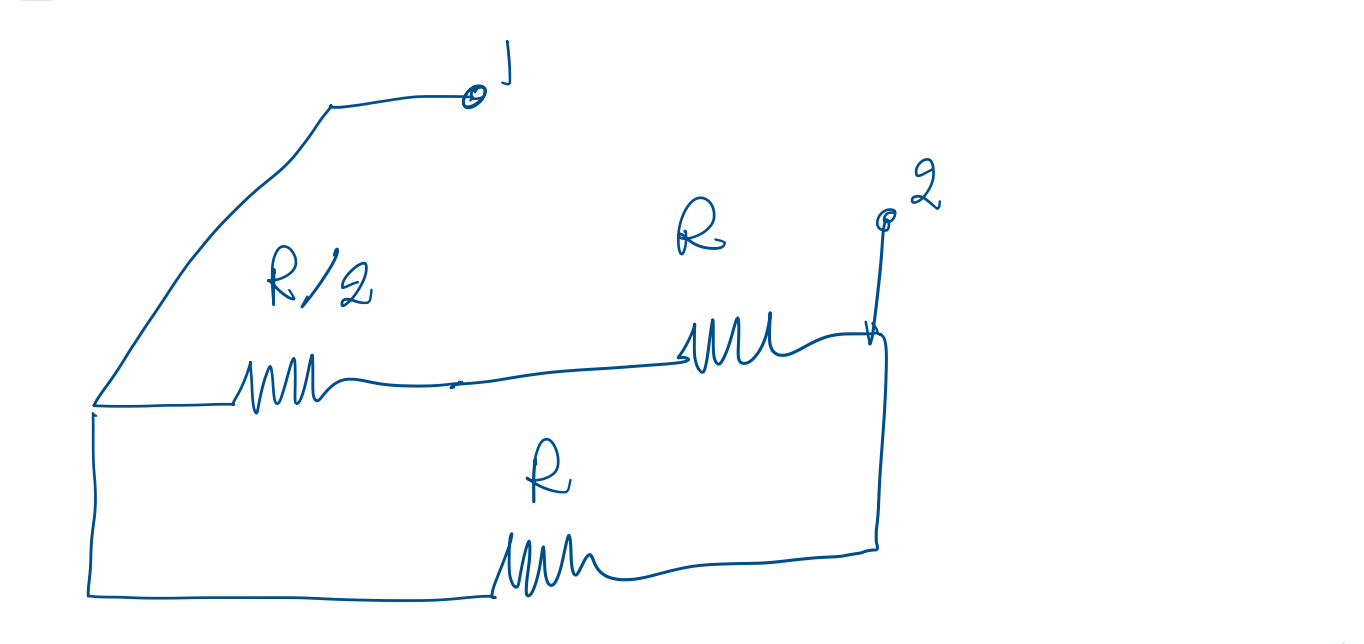
B: $I_2 = I_3 + J_1$

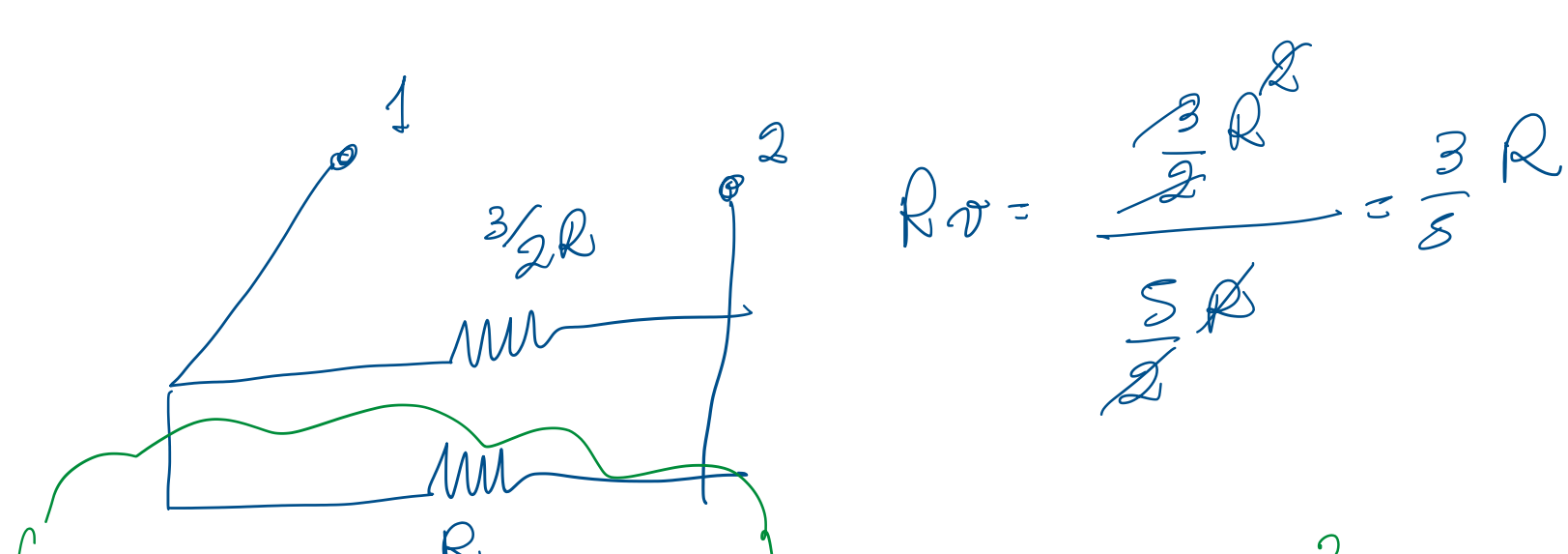
D: $I_5 + J_1 + I_4 = I_1 + \alpha I_4$

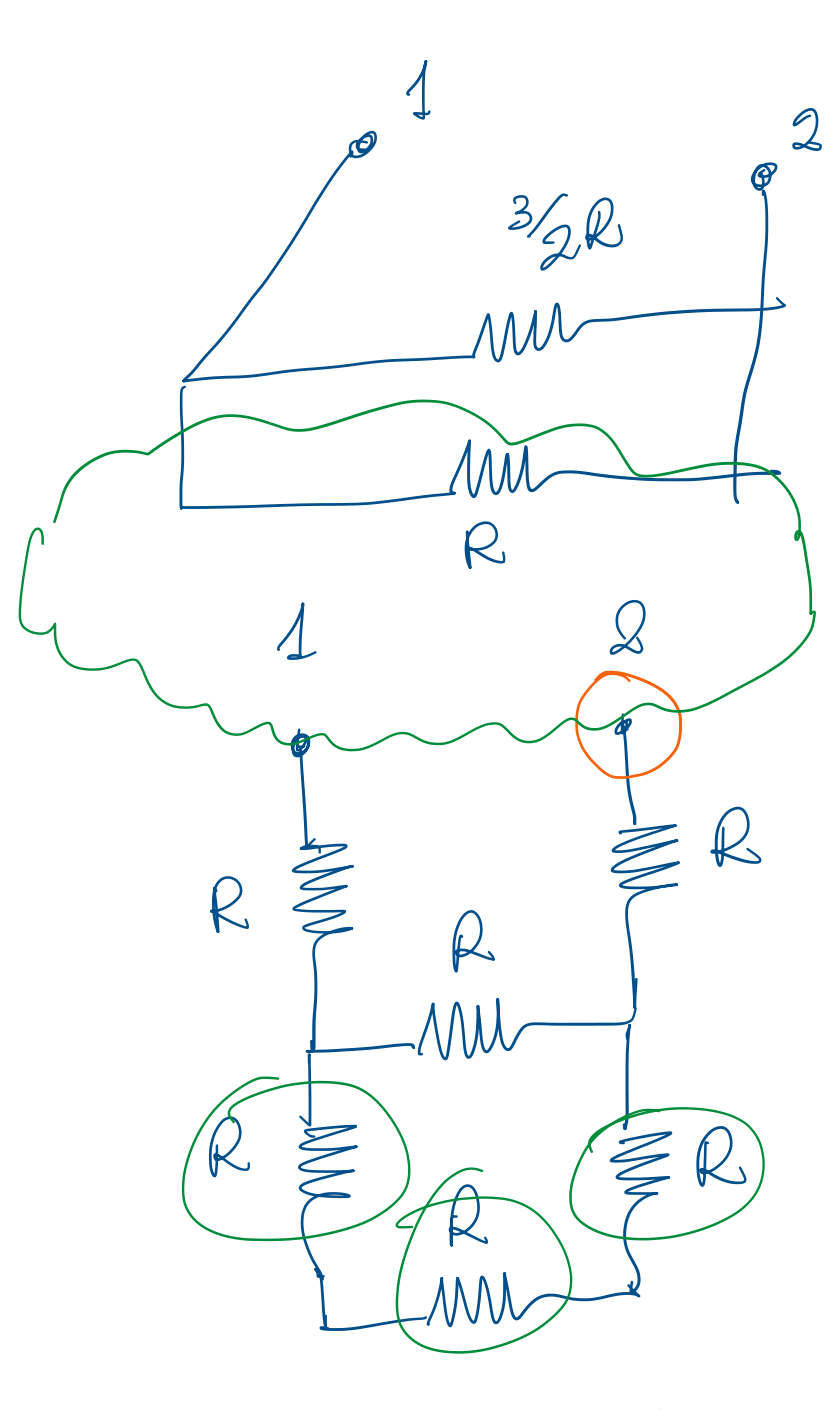
$R_1 I_1 + E_1 = 0$

$R_2 I_2 + R_3 I_3 + R_4 I_4 - E_2 - E_1 = 0$

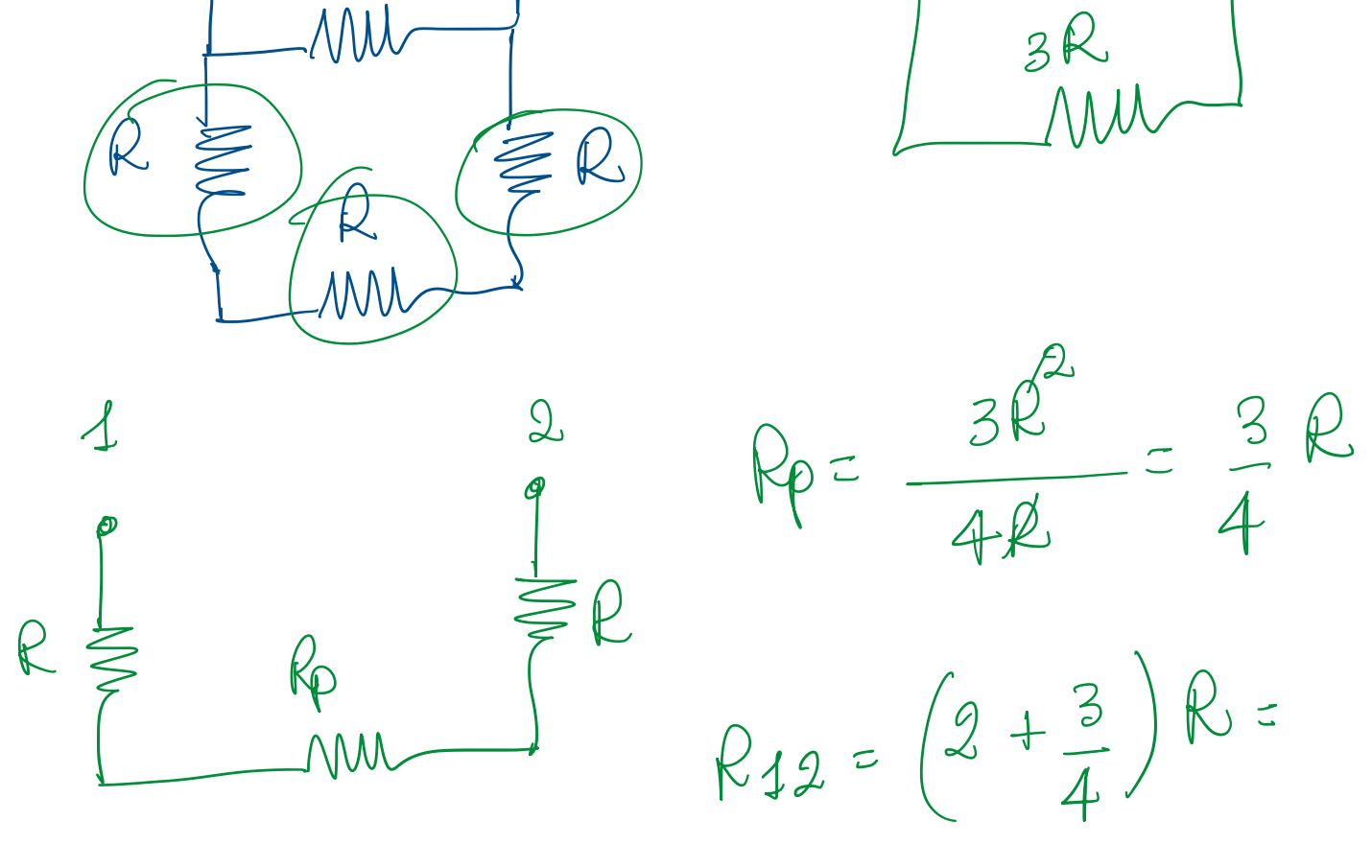
$$\begin{bmatrix} 1 & -1 & 0 & 0 & -1 \\ 0 & 1 & -1 & 0 & 0 \\ 1 & 0 & 0 & (\alpha-1) & -1 \\ R_1 & 0 & 0 & 0 & 0 \\ 0 & R_2 & R_3 & R_4 & 0 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \end{bmatrix} = \begin{bmatrix} 0 \\ J_1 \\ +J_1 \\ -E_1 \\ E_1 + E_2 \end{bmatrix}$$

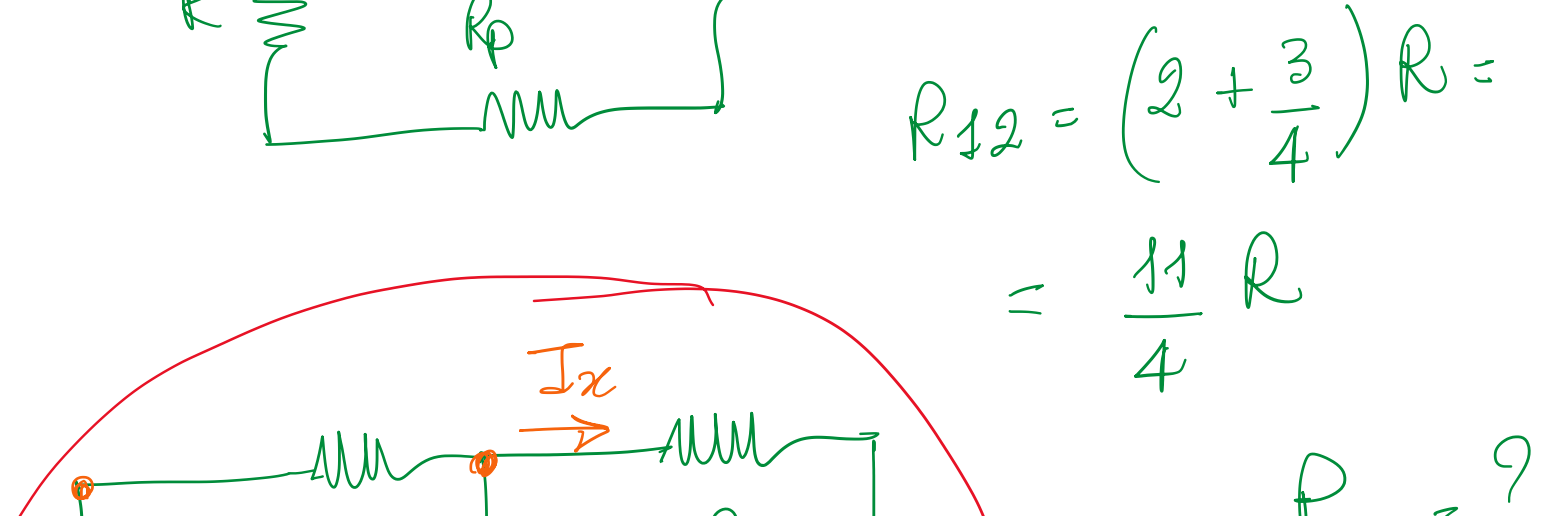






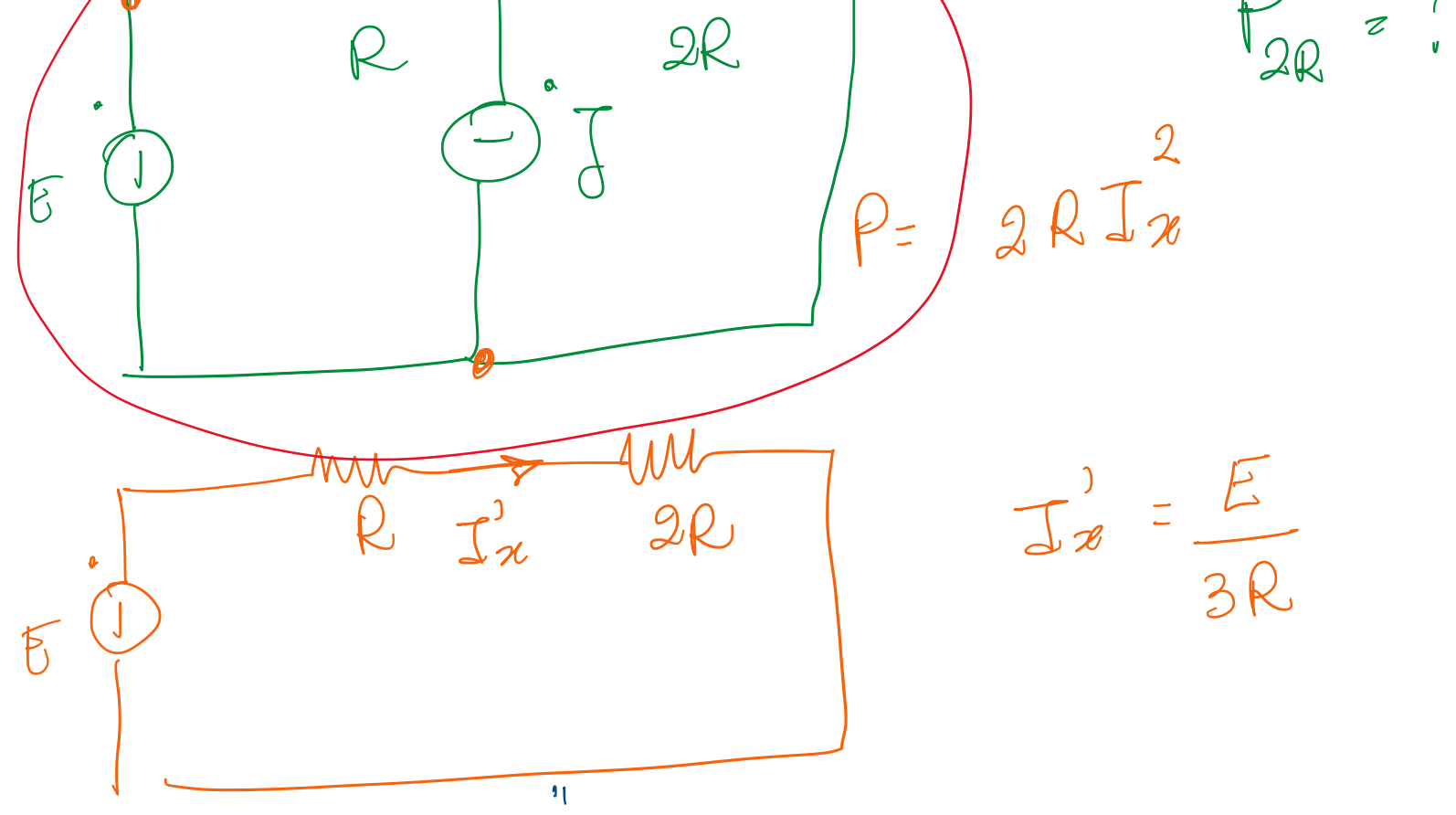
$R_\nu = \frac{\frac{3}{2}R^{\cancel{2}}}{\frac{5}{2}\cancel{R}} = \frac{3}{5}R$





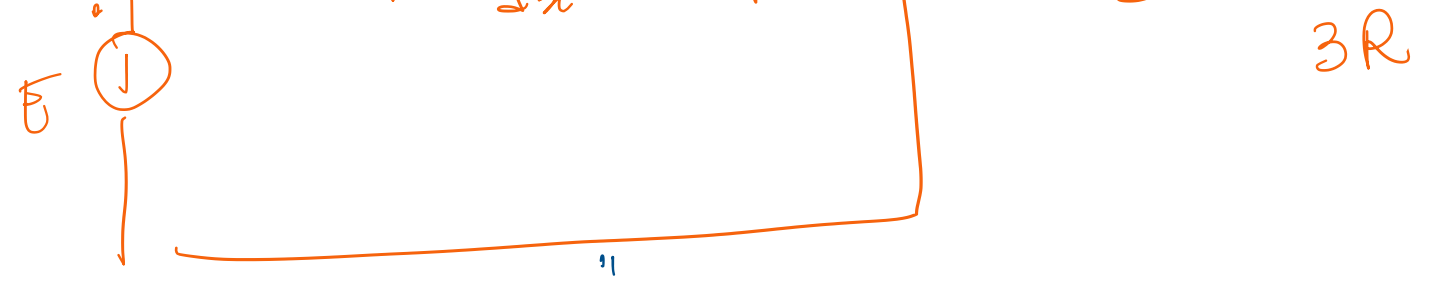
$R_p = \frac{3R^{\cancel{2}}}{4\cancel{R}} = \frac{3}{4}R$

$R_{12} = \left(2 + \frac{3}{4}\right)R = \frac{11}{4}R$

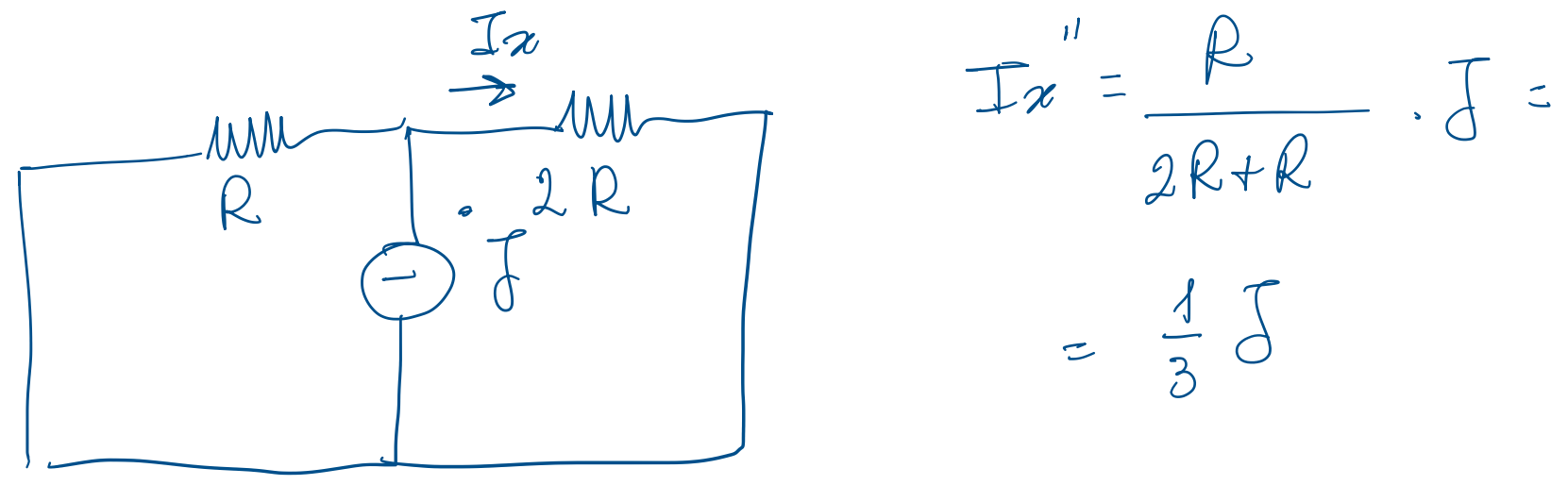


$P_{2R} = ?$

$P = 2R I_x^2$



$I_x' = \frac{E}{3R}$



$I_x'' = \frac{R}{2R+R} \cdot J = \frac{1}{3}J$

$P = 2R\left(\frac{E}{3R} + \frac{1}{3}J\right)^2$