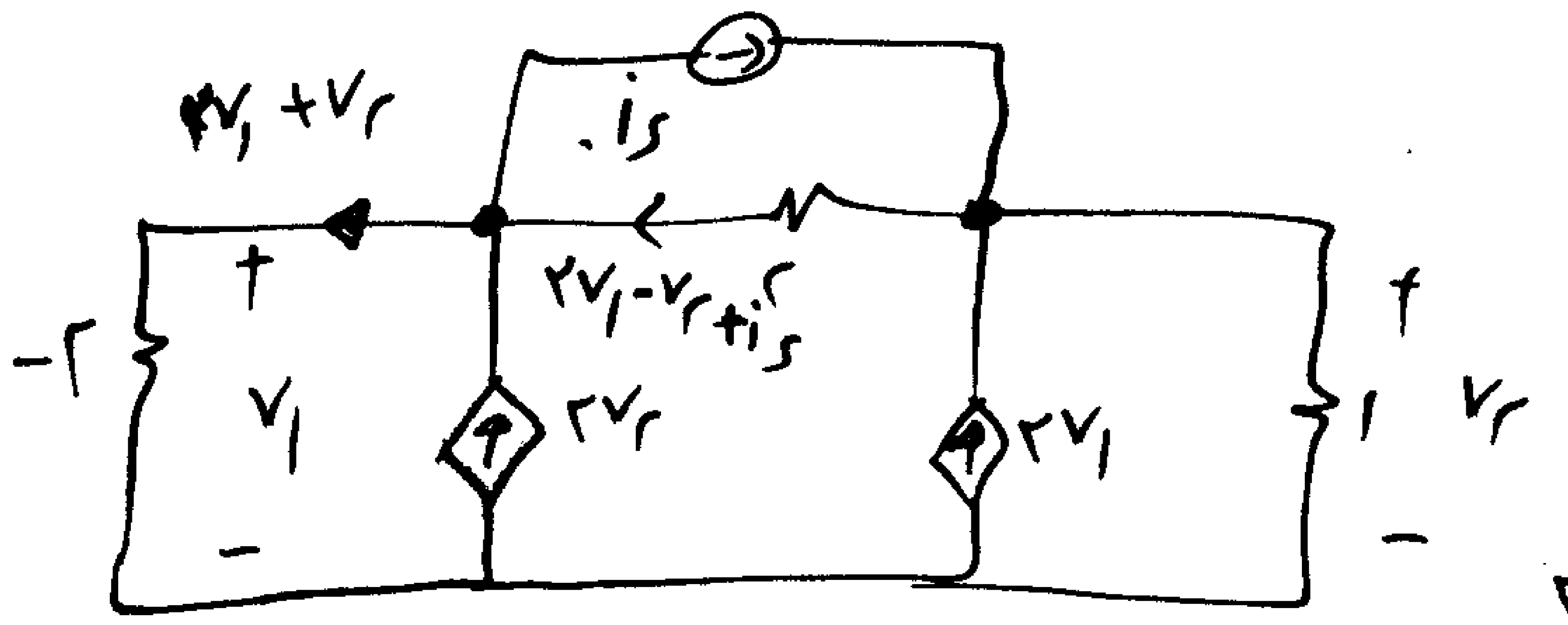
۱- گزینه‌ی (۲) صحیح است.



$$v_1 = -2(2v_1+v_2) \Rightarrow 5v_1 = -2v_2$$

KVL $$v_2 = 2(2v_1 - v_2 + i_s) + v_1$$

$$3v_2 = 5v_1 + 2i_s = -2v_2 + 2i_s \Rightarrow v_2 = \frac{2}{5} i_s$$

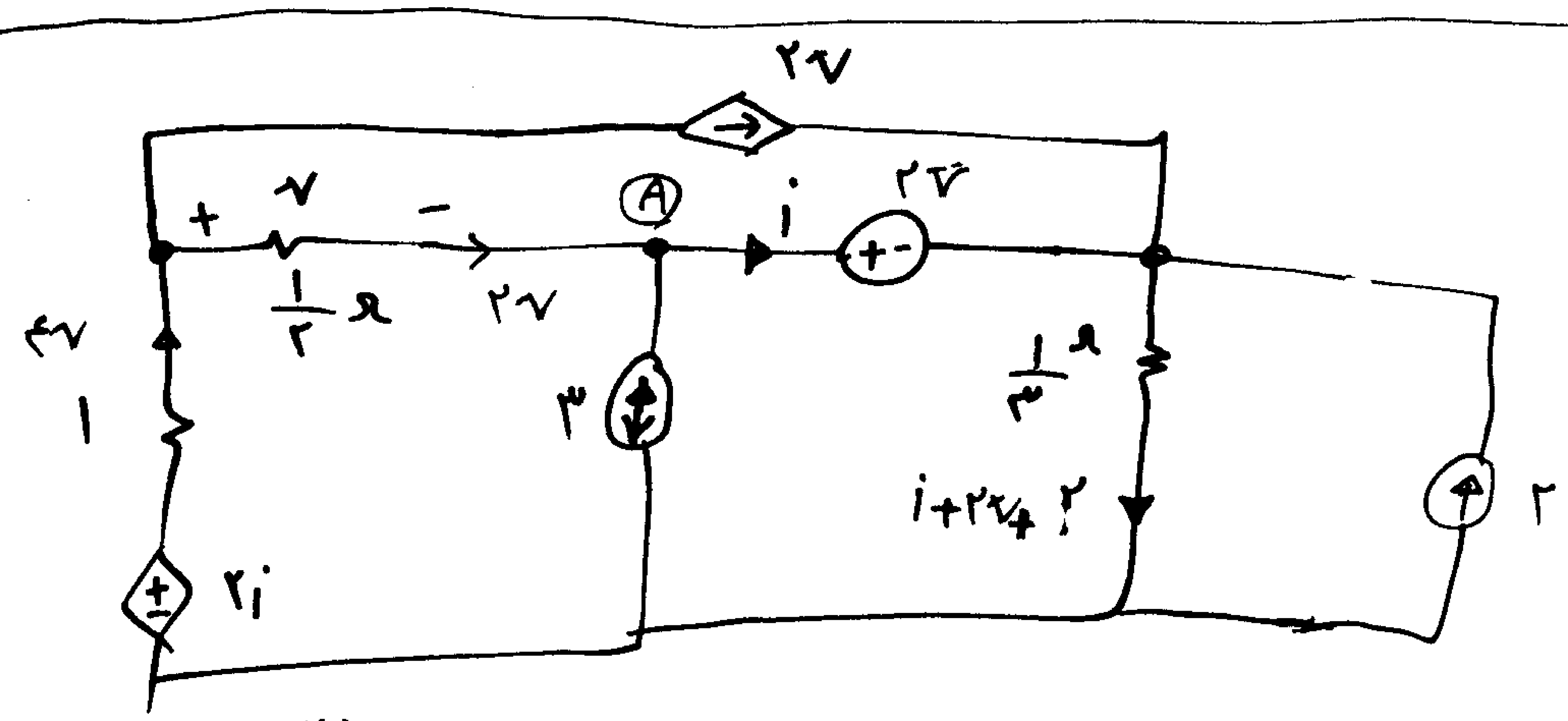
$$P(t) = -v_1 \, 2v_2 = \frac{4}{5} v_2 v_2 = \frac{4}{5} v_2^2 = \frac{4}{5} \cdot \frac{4}{25} i_s^2$$

$$P(t) = \frac{16}{125} i_s^2 = \frac{16}{125} 25\cos^2 \pi t = \frac{16}{5}\left(\frac{1+\cos 2\pi t}{2}\right) = \frac{8}{5}(1+\cos 2\pi t)$$

$$W(0,10) = \int_0^{10} p(t)\,dt = \int_0^{10} \frac{8}{5}(1+\cos 2\pi t)\,dt = \frac{8}{5}(10) = 16$$ ژ د ۰

۱۶ ژول انرژی می‌گیرد.

۲- گزینه‌ی (۳) صحیح است.



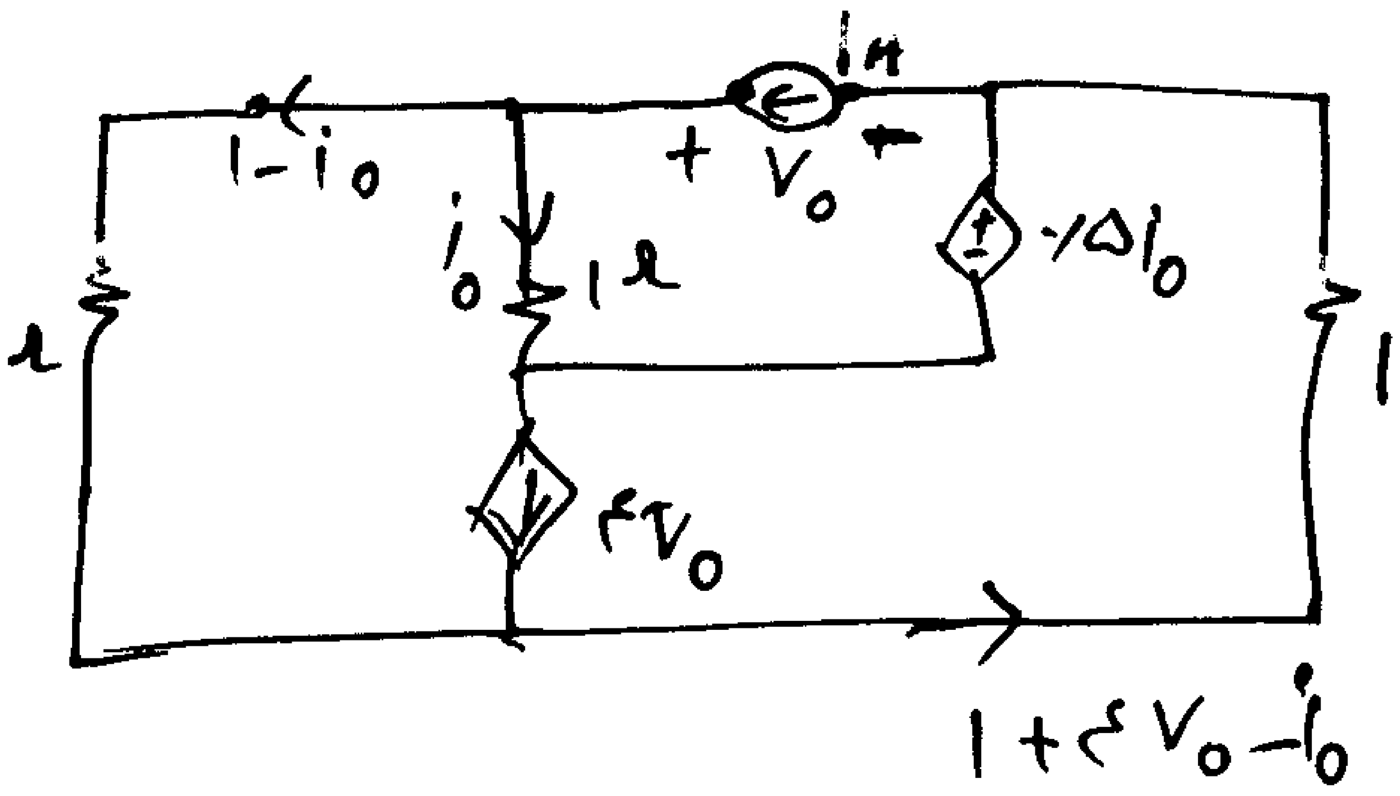
KCL$^{(A)}$ $$2v = i + 3$$

مش بیرونی KVL $$2i = 1(4v) + v + 4 + \frac{1}{3}(i + 2v - 2)$$

$$6i = 15v + 6 + i + 2v + 2 \Rightarrow 5i = 17v + 8 \Rightarrow 5(2v - 3) = 17v + 8$$

ولی $v = -\frac{23}{7}$

۳- گزینه‌ی (۴) صحیح است

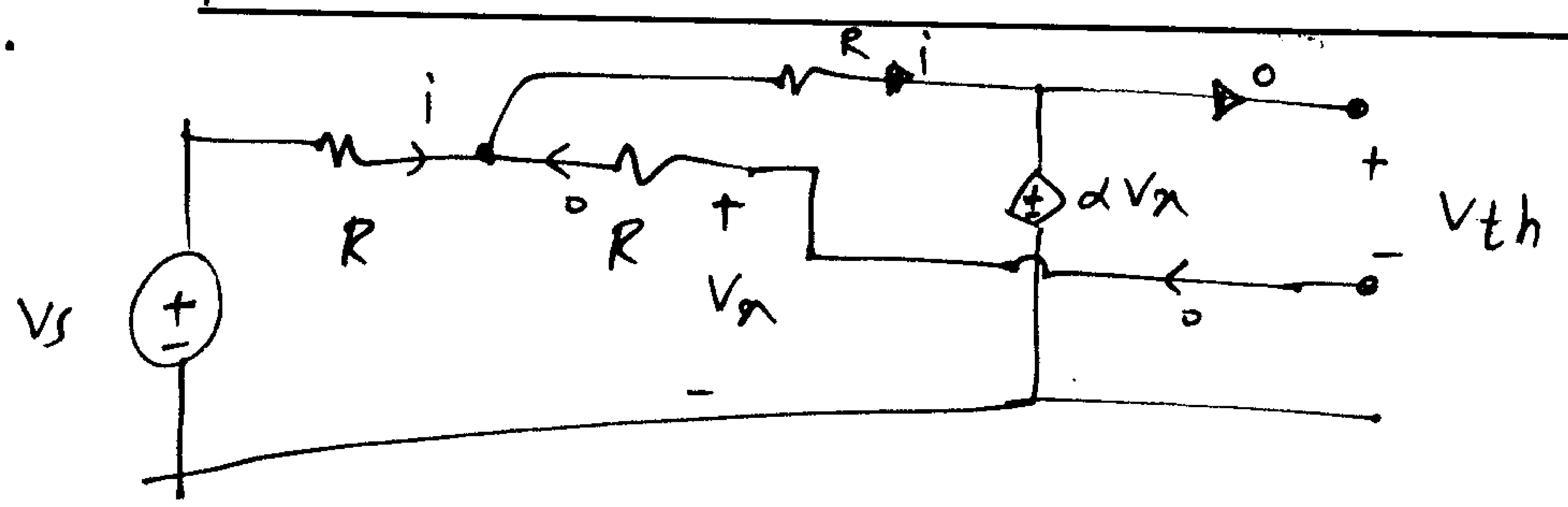


KVL $$v_0 = i_0 - 0.5 i_0 = 0.5 i_0$$

KVL $$v_0 = 1(1-i_0) + 1(1+4v_0-i_0)$$

$$3v_0 = 2i_0 - 2 = 2(2v_0) - 2$$

$$v_0 = 2 \Rightarrow R_{th} = 2\Omega \Rightarrow R = R_{th} = 2\Omega$$



۴- گزینه ی (۱) صحیح است.

KVL $\quad Ri + V_{th} + R(0) = 0 \Rightarrow V_{th} = -Ri$

KVL $\quad V_s = 2Ri + \alpha V_x \qquad$ KVL $\quad V_s = Ri - R(0) + V_x$

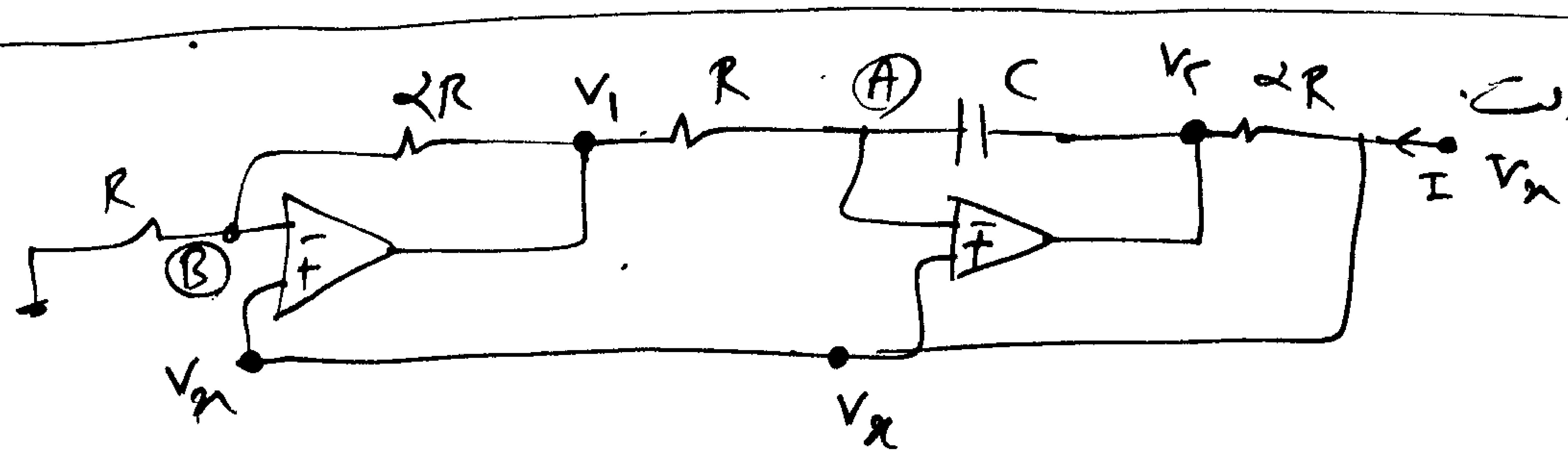
$$\Rightarrow V_x = V_s - Ri$$

$$V_s = 2Ri + \alpha V_x = 2Ri + \alpha(V_s - Ri) \Rightarrow (2-\alpha)Ri = (1-\alpha)V_s$$

$$V_{th} = -Ri = -\frac{(1-\alpha)V_s}{2-\alpha} = \frac{\alpha-1}{2-\alpha}V_s$$

$$|V_{th}| < \infty \Rightarrow \left|\frac{\alpha-1}{2-\alpha}V_s\right| < \infty \Rightarrow \alpha \neq 2$$

۵- گزینه ۳ صحیح است.



KCL ^{B} $\quad \frac{V_1 - V_x}{\alpha R} = \frac{V_x}{R} \Rightarrow V_1 = V_x(1+\alpha)$

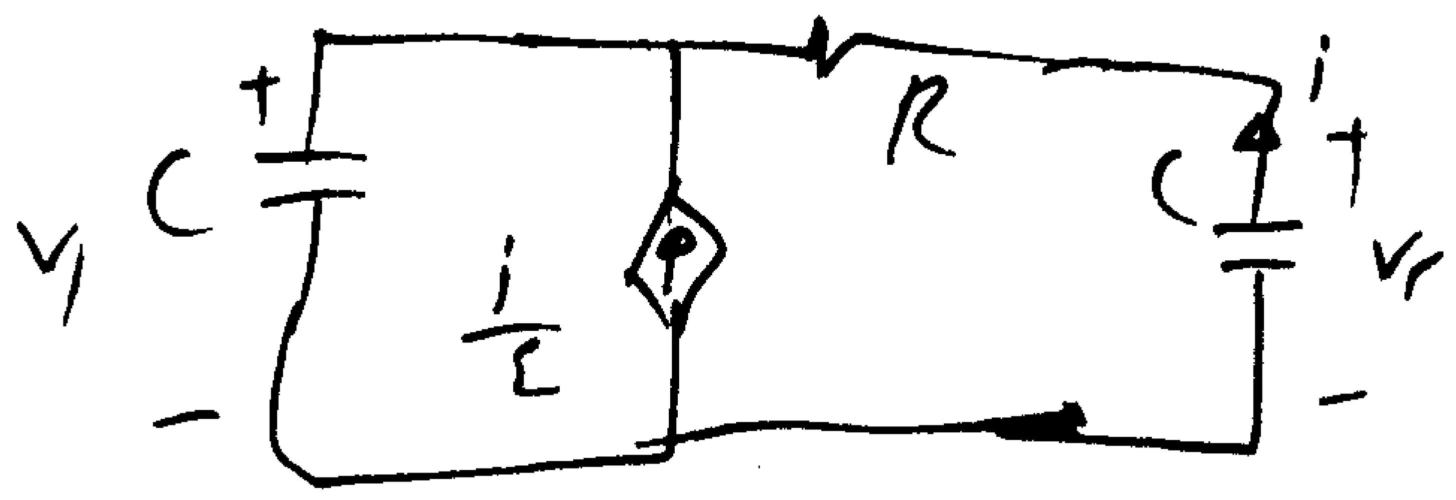
KCL ^{A} $\quad \frac{V_1 - V_x}{R} = (V_x - V_2)CS \Rightarrow \frac{V_x(1+\alpha) - V_x}{R} = CS(V_x - V_2)$

$$\alpha V_x = RCSV_x - RCSV_2 \Rightarrow V_2 = V_x - \frac{\alpha}{RCS}V_x$$

$$I = \frac{V_x - V_2}{\alpha R} = \frac{V_x - \left(V_x - \frac{\alpha V_x}{RCS}\right)}{\alpha R} = \frac{V_x}{R^2CS} \Rightarrow Z_{in} = \frac{V_x}{I}$$

$$Z_{in} = R^2CS = L_eS \Rightarrow L_e = R^2C$$

۶- گزینه‌ی ۳ صحیح است.



KCL $\quad Cv_1' + Cv_2' = \frac{i}{4}$ و $i = -Cv_2'$

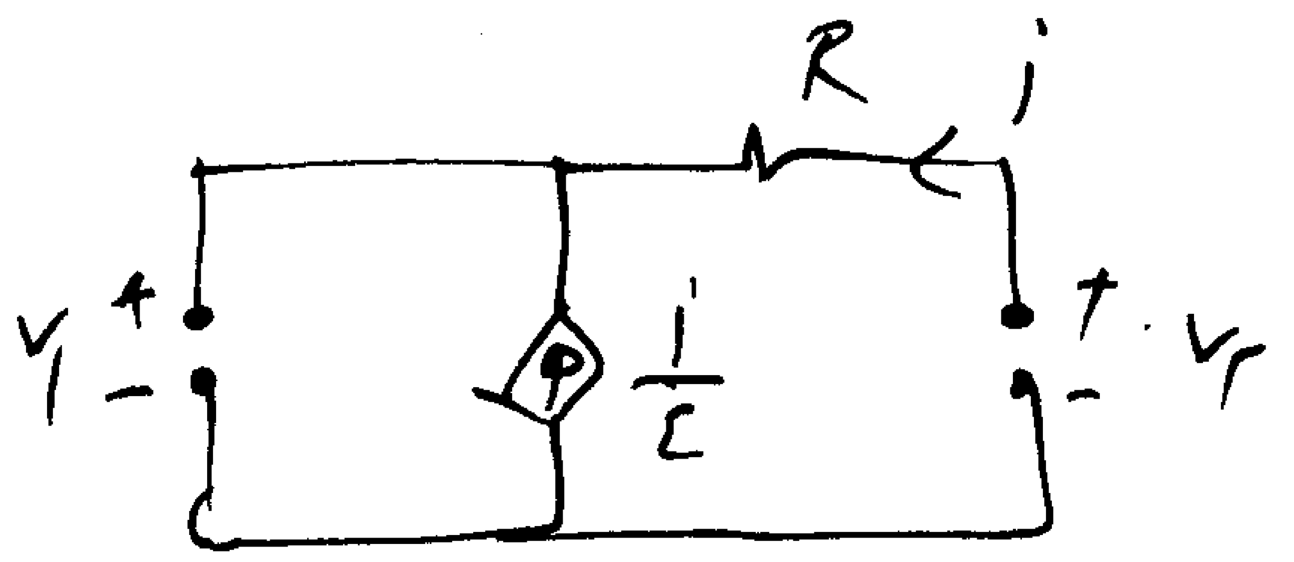
$$Cv_1' + Cv_2' = -\frac{Cv_2'}{4} \Rightarrow v_1' = -\frac{5}{4}v_2'$$

$$v_1(t) - v_1(0) = -\frac{5}{4}\left(v_2(t) - v_2(0)\right)$$

$$v_1(t) - 0/75 = -\frac{5}{4}\left(v_2(t) - 3\right) \Rightarrow 4v_1(t) - 3 = -5v_2(t) + 15$$

$$4v_1(t) + 5v_2(t) = 18$$

در $t=\infty$ مطابق شکل زیر خازن‌ها مدار باز هستند. لذا:

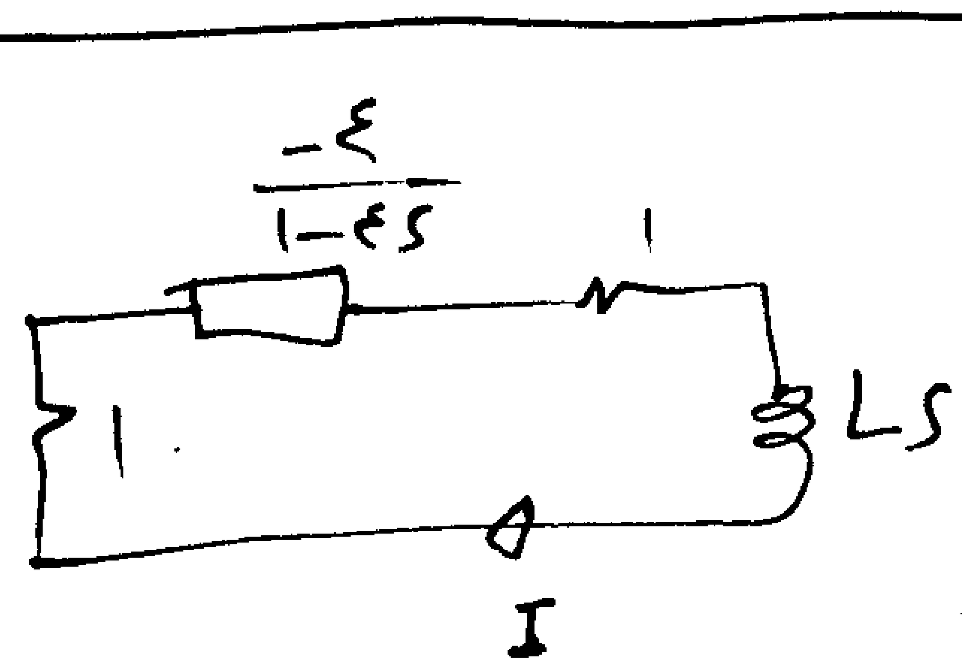


$$i = 0 \Rightarrow v_1(\infty) = v_2(\infty)$$

$$4v_1(\infty) + 5v_2(\infty) = 18 \Rightarrow 9v_2(\infty) = 18$$

$$v_1(\infty) = v_2(\infty) = 2$$

۷- گزینه‌ی ۱ صحیح است.



$$\left(Ls + 2 - \frac{4}{1-4s}\right)I = 0$$

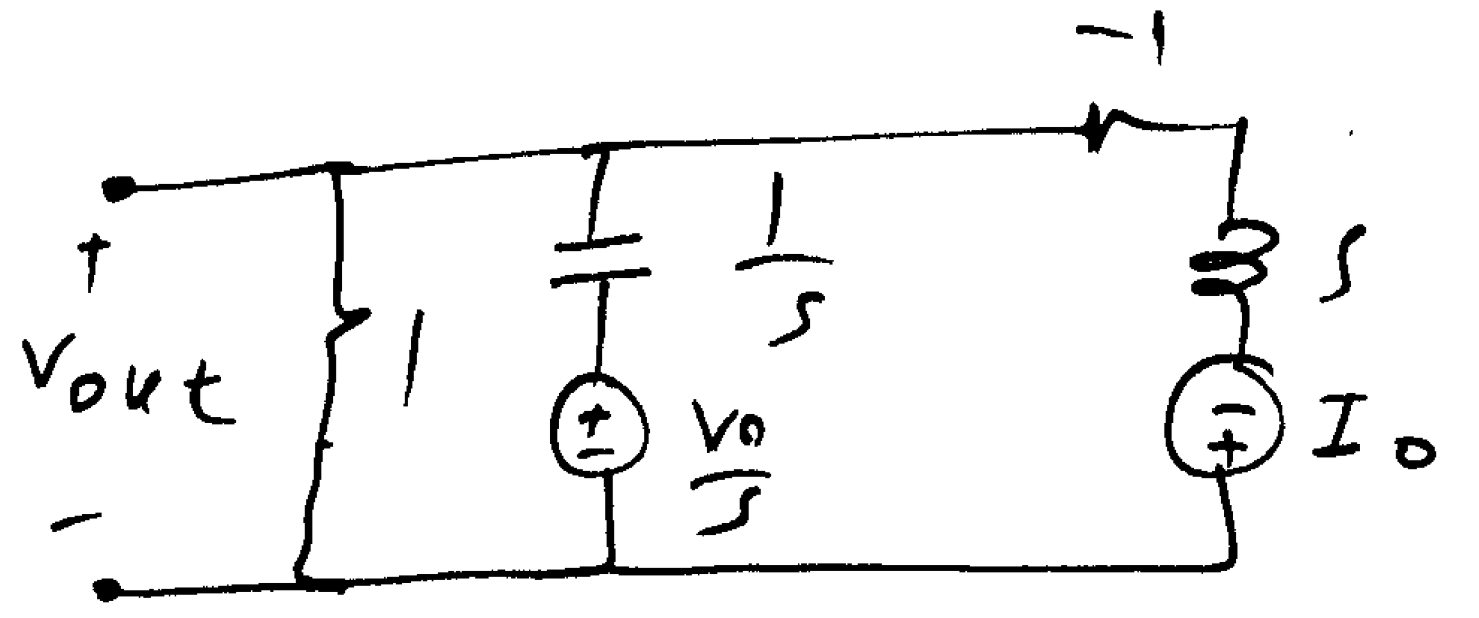
$$(Ls+2)(1-4s) - 4 = 0$$

$$Ls - 4Ls^2 + 2 - 8s - 4 = 0 \Rightarrow 4Ls^2 + 2 + (8-L)s = 0$$

ضرایب معادله مثبت $\Rightarrow$ مدار پایداری

$$4L > 0 \text{ و } 8 - L > 0 \Rightarrow 0 < L < 8\,H$$

۸- گزینه‌ی ۲ صحیح است.



$$KCL \quad \frac{V_{out}}{1} + s\left(V_{out} - \frac{V_0}{s}\right) + \frac{V_{out} + I_0}{s-1} = 0$$

$$(s+1)V_{out} - V_0 + \frac{V_{out} + I_0}{s-1} = 0$$

$$((s^2-1)+1)V_{out} = V_0(s-1) - I_0 \Rightarrow V_{out} = \frac{V_0(s-1) - I_0}{s^2}$$

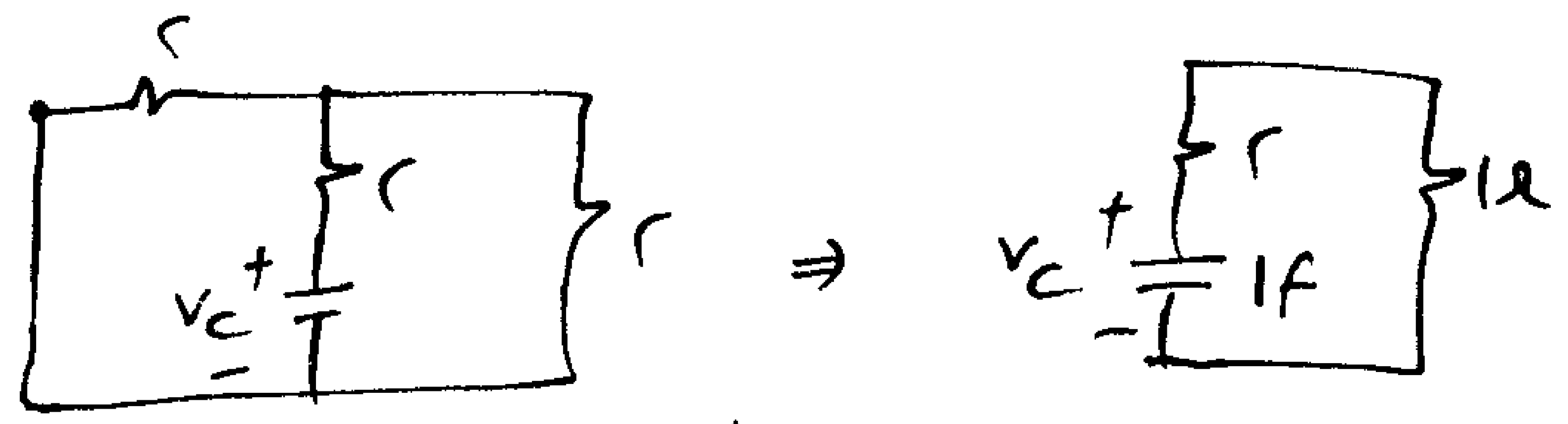
$$V_{out} = \frac{V_0}{s} - \frac{V_0 + I_0}{s^2} \Rightarrow V_{out} = V_0 - (V_0 + I_0)t$$

برای این که V_{out} در $t=\infty$ کراندار باشد باید داشته باشیم:

$$V_0 + I_0 = 0 \Rightarrow V_0 = -I_0$$

۹- گزینه‌ی ۳ صحیح است.

$0<t<3\ln(2)$

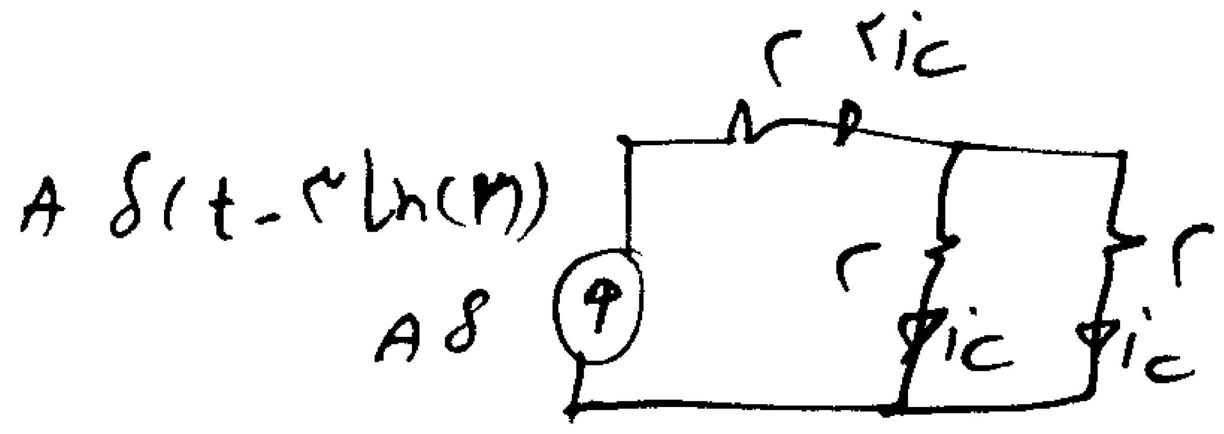


$$\Rightarrow \tau = 3 \,,\quad v_c(t) = v_c(0)e^{-\frac{t}{3}}$$

$$v_c(t) = 2e^{-\frac{t}{3}}$$

$$v_c(3\ln 2) = 2e^{-\frac{3\ln(2)}{3}} = 2e^{-\ln(2)} = 2\left(\frac{1}{2}\right) = 1$$

حال در $t = 3\ln(2)$ داریم:

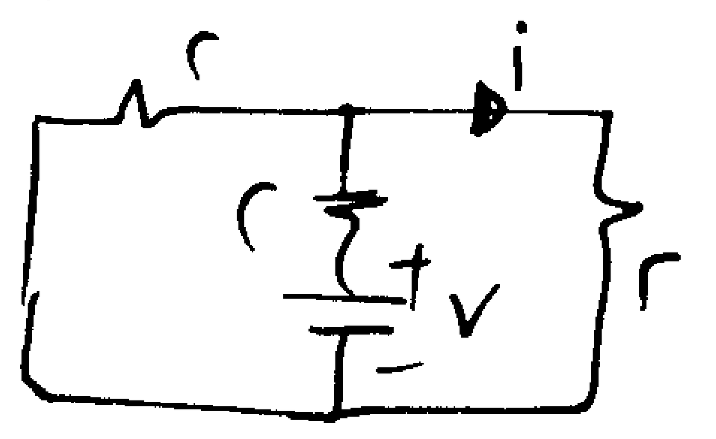


$$\Rightarrow A\delta = 4i_c + 2(i_c) \Rightarrow i_c = \frac{A}{6}\delta(t-3\ln 2)$$

$$v_c(3\ln 2^+) - v_c(3\ln 2^-) = \frac{A'}{C} = \frac{\frac{A}{6}}{1} = \frac{A}{6}$$

$$v_c(3\ln(2^+)) - 1 = \frac{A}{6} \Rightarrow v_c(3\ln 2^+) = 1 + \frac{A}{6}$$

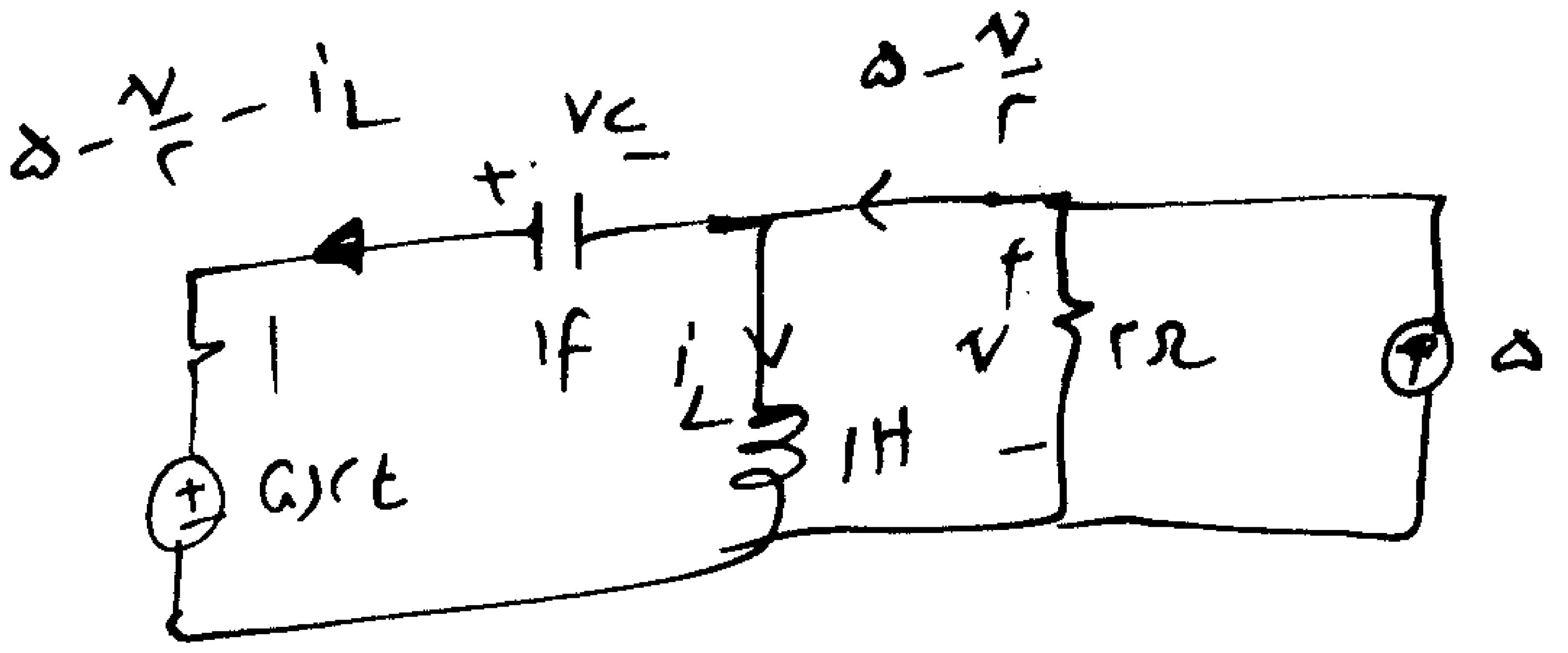
$t > 3\ln(2)^+$:



$$i = 0 \Rightarrow v_c(3\ln 2^+) = 0$$

$$1 + \frac{A}{6} = 0 \Rightarrow A = -6$$

۱۰- گزینه ۳



$$KVL \quad v = -v_C + 1\left(5 - \frac{v}{2} - i_L\right) + \cos 2t$$

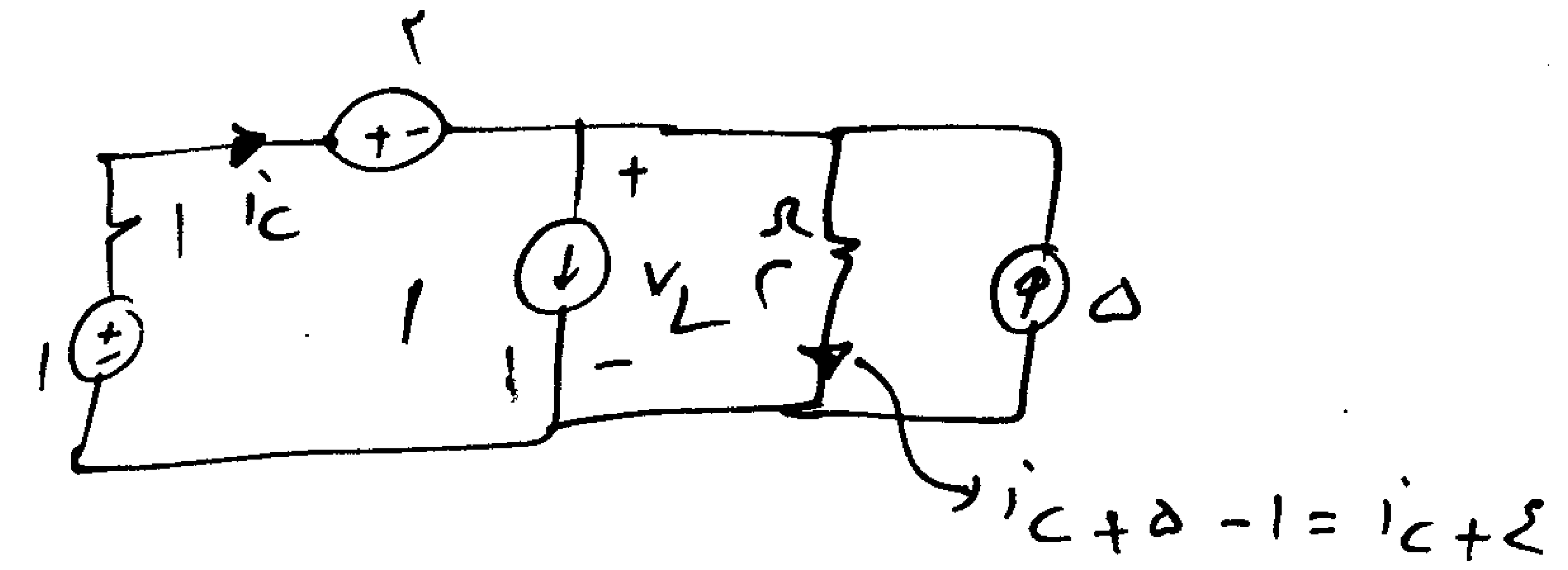
$$1.5\,v = 5 + \cos 2t - i_L - v_C \Rightarrow 1.5\,v' = -\sin 2t - i_L' - v_C'$$

$$1.5\,v'(0^+) = 0 - i_L'(0^+) - v_C'(0^+) = -\frac{v_L(0^+)}{\frac{1}{2}} - \frac{i_C(0^+)}{1}$$

$$1.5\,v'(0^+) = -2\,v_L(0^+) - i_C(0^+) \Rightarrow \boxed{v'(0^+) = -\frac{4}{3}v_L(0^+) - \frac{2}{3}i_C(0^+)}$$

$t=0^+$

مدل‌گذاری



$$1 = 1(i_C) + 2 + 2(i_C+4) \Rightarrow 3i_C = -9 \Rightarrow \boxed{i_C(0^+) = -3}$$

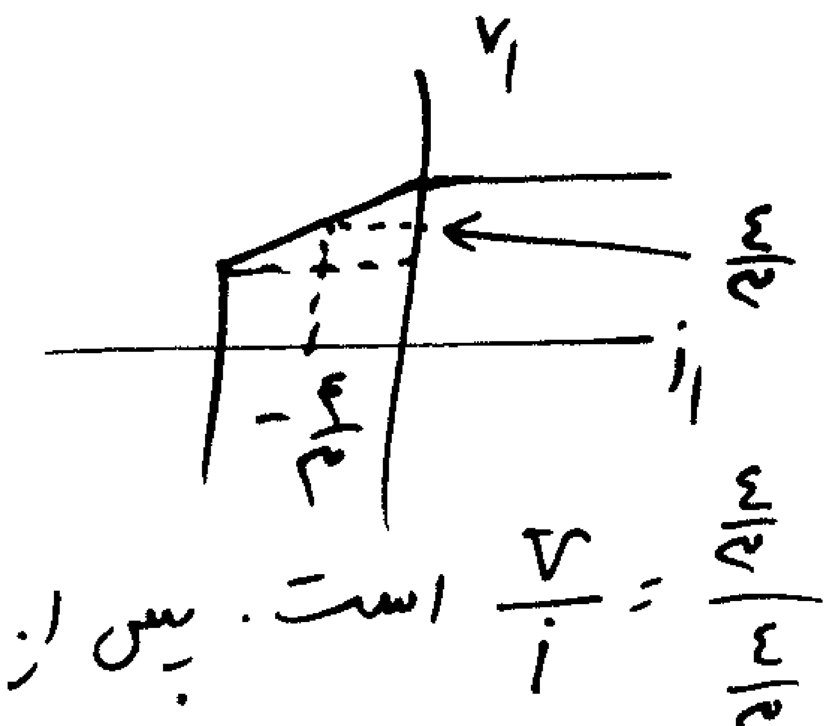
$$v_L(0^+) = 2\left(i_C(0^+)+4\right) = 2(-3+4) = 2$$

$$v'(0^+) = -\frac{4}{3}v_L(0^+) - \frac{2}{3}i_C(0^+) = -\frac{4}{3}(2) - \frac{2}{3}(-3) = -\frac{2}{3}$$

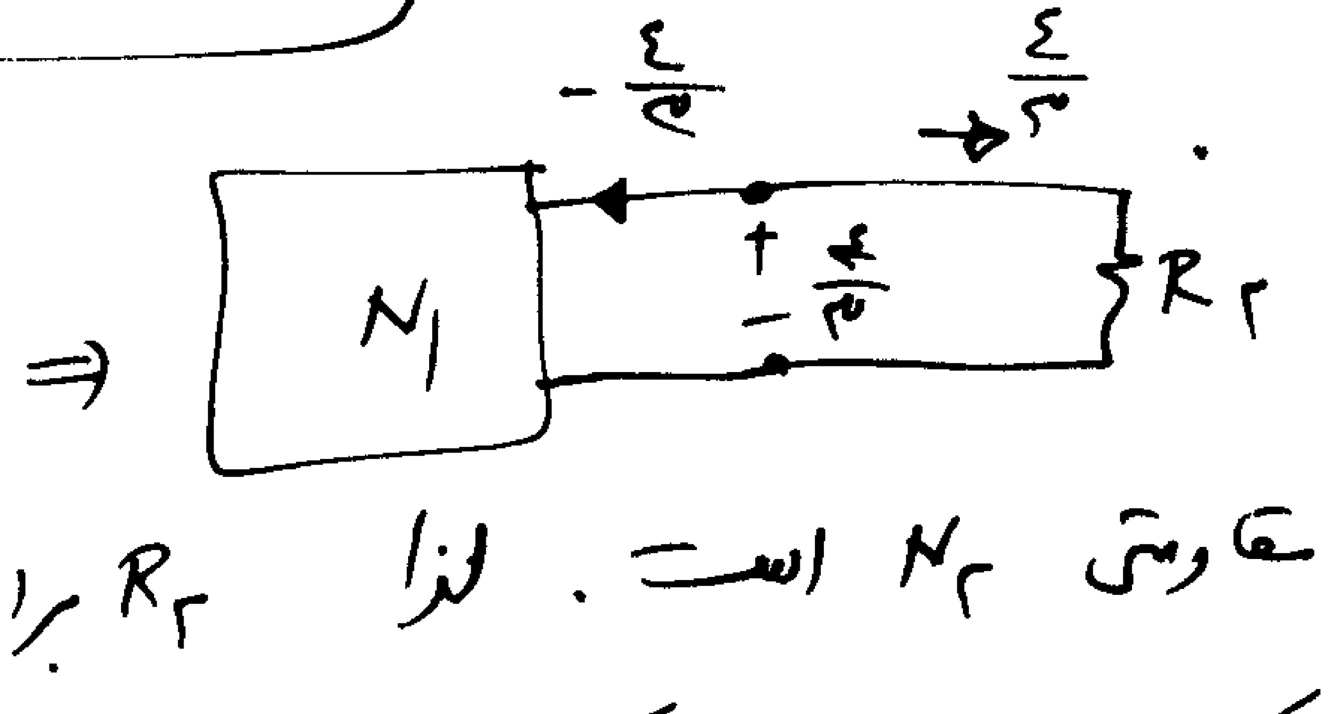
۱۱- گزینه ۳ صحیح است.

$$\text{نمودار} \Rightarrow v_1 = \frac{4}{3} \Rightarrow 1 < v_1 < 2 \Rightarrow v_1 = \frac{1}{2}i_1 + 2$$

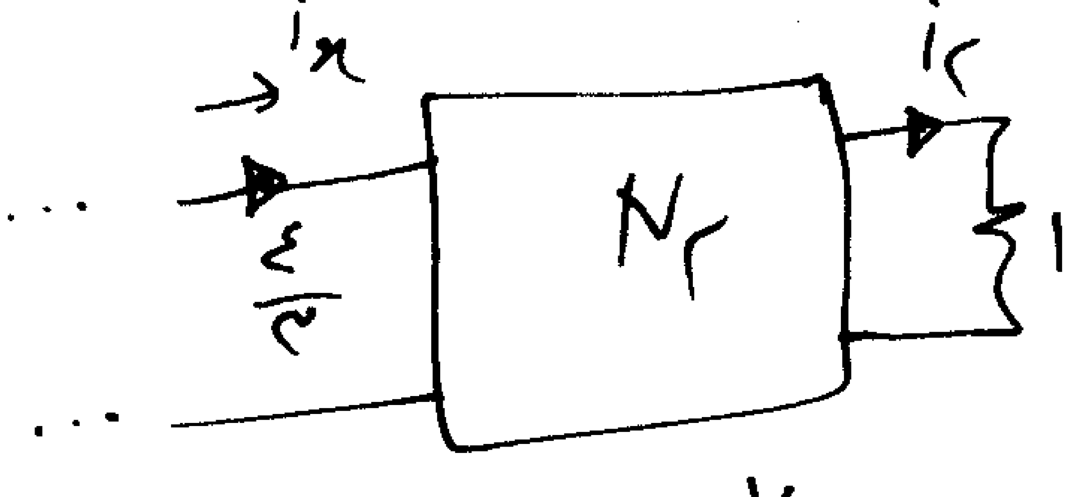
$$v_1 = +\frac{4}{3} = \frac{1}{2}i_1 + 2 \Rightarrow \boxed{i_1 = -\frac{4}{3}\,A}$$



$\Rightarrow$



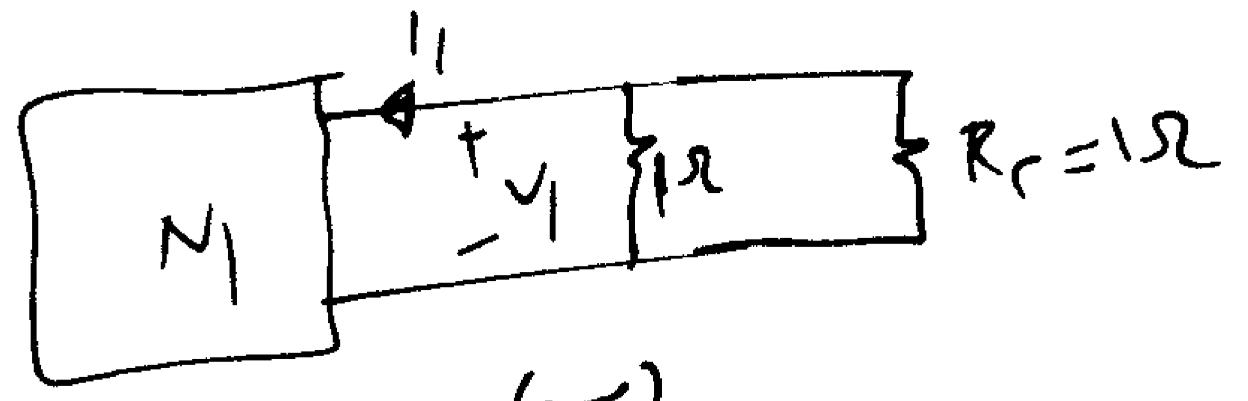
R_2 معادل شبکه مقاومتی N_2 است. لذا R_2 برابر $\frac{v}{i} = \frac{\frac{4}{3}}{\frac{4}{3}} = 1\Omega$ است. پس از دید ورودی N_2 که شبکه N_2 به صورت یک مقاومت 1Ω است. از طرفی در شکل مقابل جریان $\frac{4}{3}$ شبکه N_2 را تحریک می‌کند و لذا داریم:



الف

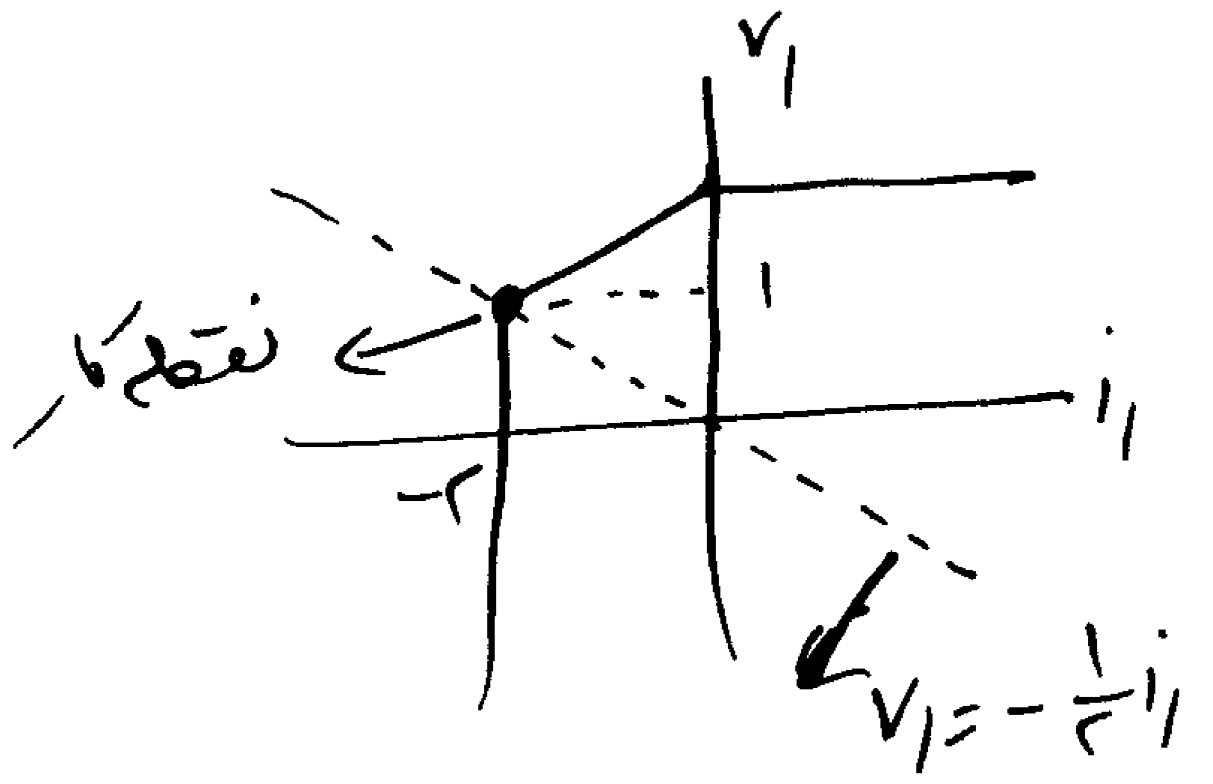
$$i_2 = 1 = \alpha\, i_x = \alpha\, \frac{4}{3} \Rightarrow \boxed{\alpha = \frac{3}{4}}$$

حال در شکل ب داریم:

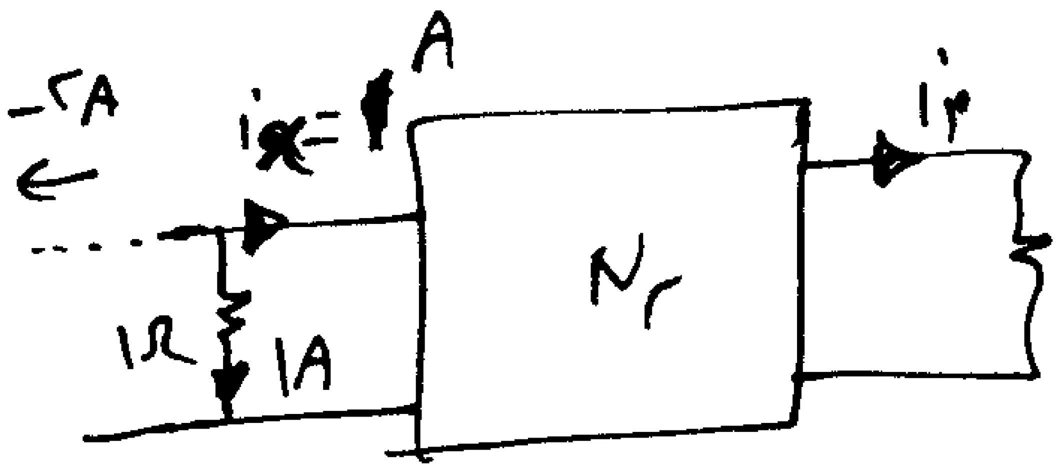


(ب)

$$\Rightarrow i_1 + \frac{v_1}{1} + \frac{v_1}{1} = 0 \Rightarrow \boxed{v_1 = -\frac{1}{2} i_1}$$



$$\Rightarrow v_1 = +1 \;,\; i_1 = -2$$

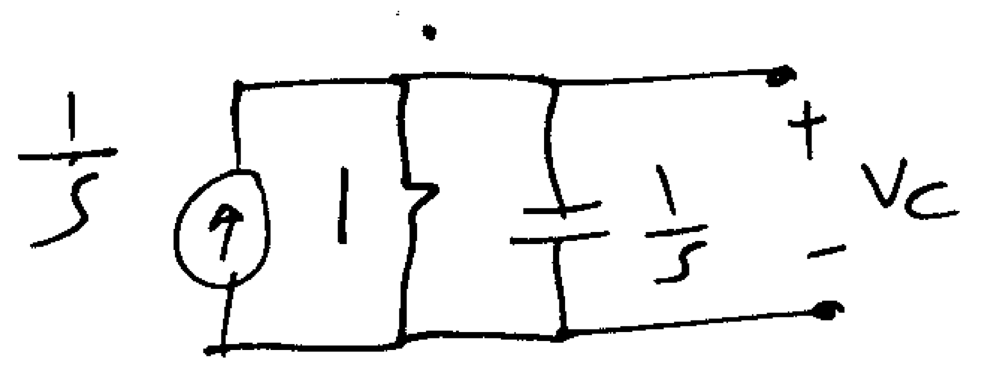


(ب)

$$i_2 = \alpha\, i_x = \alpha(1) = \frac{3}{4}(1) = \boxed{\frac{3}{4}}$$

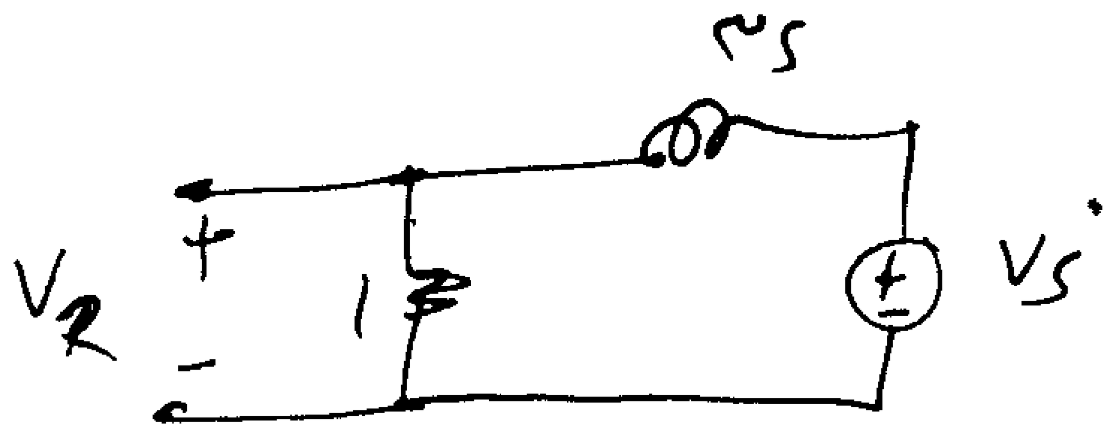
در حالت ب جریان ورودی به شبکه ی N_2 برابر $1A$ است. حال آن که در آزمایش الف برابر $\frac{4}{3}A$ بوده است.

۱۲- گزینه ی ۱



(الف)

$$\frac{1}{s} = V_C + sV_C \Rightarrow \boxed{V_C = \frac{1}{s(s+1)}}$$



$$V_R = V_C = \frac{1}{s(s+1)} = \frac{V_s(1)}{1+3s}$$

$$V_s = \frac{1+3s}{s(s+1)} = \frac{1}{s} + \frac{2}{s+1}$$

$$v_s(t) = (1+2e^{-t})\,u(t)$$

موفق باشید. رضا ...