Last Name _____ Last Name _____ Matricola _____

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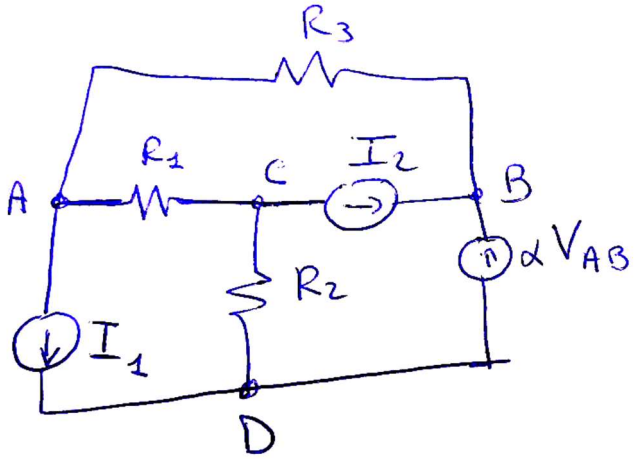
Exercise 1

Solve the given circuit below by using the node analysis and D as a reference node (A, B and C are the nodes 1, 2 and 3).

a) Write the G matrix in analytical form.

b) Compute the value of the voltage at the node A, B and C, using the following values for $R_1 = 2\ \Omega$, $R_2 = 6\ \Omega$, $R_3 = 4\ \Omega$, $I_1 = 4$ A, $I_2 = 1$ A, and $\alpha = -1$;



Exercise 2

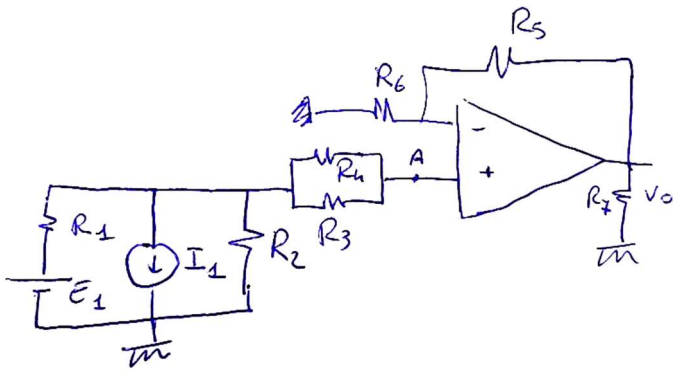
Solve the given circuit below.

a) Compute analytically the Thevenin Equivalent circuit from node A considering the positive node of the voltage Thevenin generator toward the node A.

b) Compute V_0 analytically.

c) Compute the value of V_0 considering the following parameters $R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 3\ \Omega$, $R_4 = 2\ \Omega$, $R_5 = 5\ \Omega$, $R_6 = 10\ \Omega$, $R_7 = 100\ \Omega$, $I_1 = 4$ A, and $E_1 = 4$ V.

d) Compute the value of V_+ considering the same values for the devices as reported in the point c).



Exercise 3

Draw the circuit which can solve the following differential equation: $\frac{1}{2}\frac{d^2v_0}{dt^2} = -\frac{4}{3}\frac{dv_0}{dt} - v_0 + 6\cos(10t)$. The initial conditions are set to zero, use R and C in order that the product RC=1 s. Do not assign values to R and/or C.

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Exercise 1:

a)

b)

Exercise 2:

a)

b)

c)

d)

Exercise 3:

Solution 1

a)

$$\begin{pmatrix} G_1+G_3 & -G_3 & -G_1 \\ -G_3 & G_3 & 0 \\ -G_1 & 0 & G_1+G_2 \end{pmatrix}\begin{pmatrix} V_A \\ V_B \\ V_C \end{pmatrix}=\begin{pmatrix} -I_1 \\ I_2+\alpha V_A-\alpha V_B \\ -I_2 \end{pmatrix} \rightarrow \begin{pmatrix} G_1+G_3 & -G_3 & -G_1 \\ -G_3-\alpha & G_3+\alpha & 0 \\ -G_1 & 0 & G_1+G_2 \end{pmatrix}\begin{pmatrix} V_A \\ V_B \\ V_C \end{pmatrix}=\begin{pmatrix} -I_1 \\ I_2 \\ -I_2 \end{pmatrix}$$

b) V_A = -40.67 V; V_B = -42 V; V_C = -32 V

Solution 2

a)

$$E_{TH}=\frac{-I_1+E_1/R_1}{1/R_1+1/R_2}$$

$$R_{TH}=\frac{R_1R_2}{R_1+R_2}+\frac{R_3R_4}{R_3+R_4}$$

b) This is a non-inverting amplifier. V_0 is given by

$$V_0=E_{TH}(1+\frac{R_5}{R_6})$$

c) V_0 = -4 V

d) $V_+=E_{TH}=-2.667V$

Solution 3

We rewrote the equation as

$$\frac{d^2v_0}{dt^2}=-\frac{8}{3}\frac{dv_0}{dt}-2v_0+12\cos(10t)$$