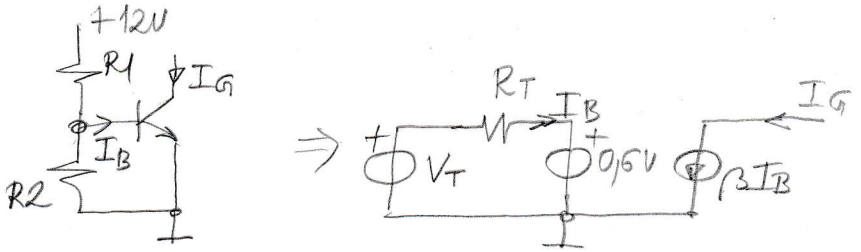
(1)

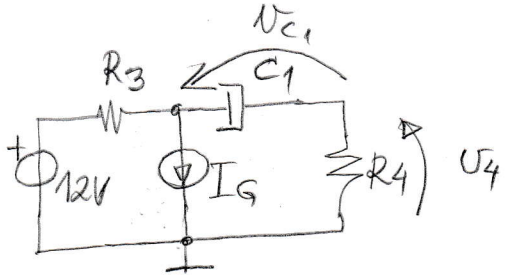


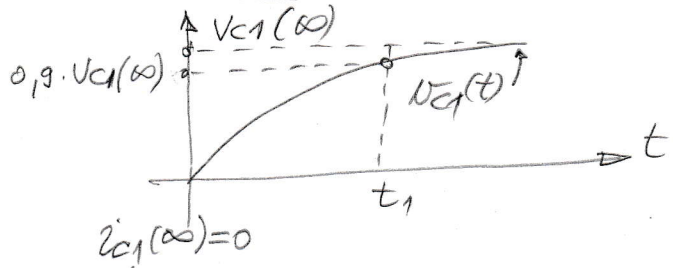
$$V_T = \frac{R_2}{R_1+R_2}\cdot 12 = 2{,}863\,V$$

$$R_T = \frac{R_1\cdot R_2}{R_1+R_2} = 35{,}79\,k\Omega$$

$$I_B = \frac{V_T - 0{,}6}{R_T} = \frac{2{,}863-0{,}6}{35{,}79\cdot 10^3} = \underline{63{,}23\,\mu A}$$

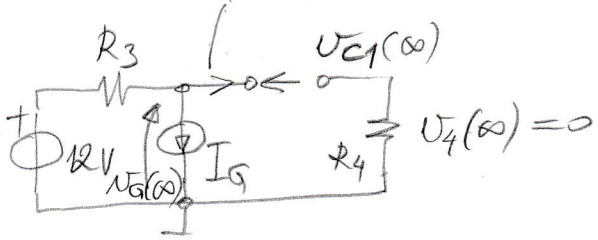
$$I_G = \beta I_B = 100\cdot 63{,}23\cdot 10^{-6} = \underline{6{,}323\,mA}$$





$v_{C_1}(0) = 0$

$v_{C_1}(\infty) = ?$ ←



$$v_G(\infty)\cdot\frac{1}{R_3} - 12\,\frac{1}{R_3} = -I_G$$

$$v_G(\infty) = 12 - R_3 I_G = 12 - 10^3\cdot 6{,}323\cdot 10^{-3}$$

$$\underline{v_G(\infty) = 5{,}677\,V} \Rightarrow v_{C_1}(\infty) = v_G(\infty) - v_4(\infty) = 5{,}677 - 0 = 5{,}677\,V$$

$$v_{C_1}(t_1) = 0{,}9\cdot v_{C_1}(\infty) = v_{C_1}(\infty) + [v_{C_1}(0) - v_{C_1}(\infty)]\,e^{-\frac{t_1}{\tau}}$$

$$= 5{,}677 + [0 - 5{,}677]\,e^{-\frac{t_1}{\tau}}$$

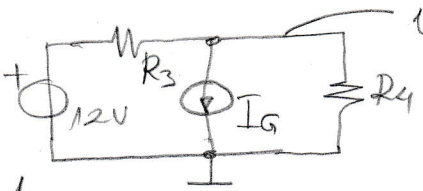
$$0{,}1\cdot 5{,}677 = 5{,}677\cdot e^{-\frac{t_1}{\tau}}$$

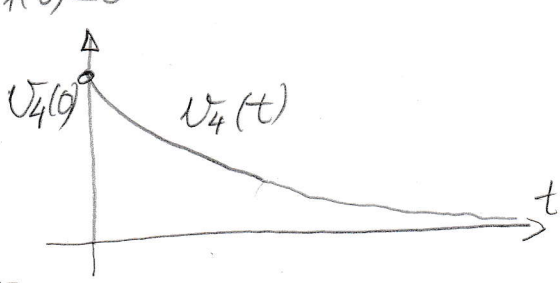
$$e^{-\frac{t_1}{\tau}} = 0{,}1 \Rightarrow e^{+\frac{t_1}{\tau}} = 10 \Rightarrow t_1 = \tau\cdot \ln 10$$

$$\underline{\tau = C_1(R_3+R_4) = 100\cdot 10^{-6}\cdot 2\cdot 10^3 = 0{,}2\,ms}$$

$$t_1 = 0{,}2\cdot 10^{-3}\cdot \ln 10 = \underline{0{,}46\,ms = 460\,\mu s}$$

$v_4(0) = ?$ ←



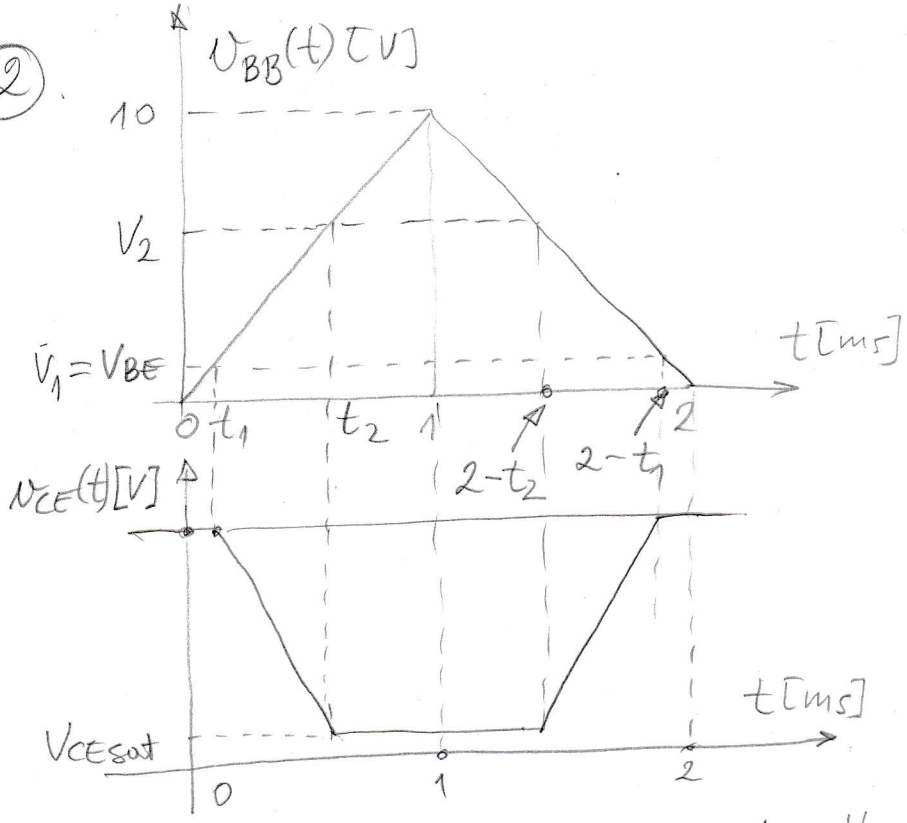


$$v_4(0)\cdot\left(\frac{1}{R_3}+\frac{1}{R_4}\right) - 12\cdot\frac{1}{R_3} = -I_G$$

$$v_4(0) = \frac{\frac{12}{R_3} - I_G}{\frac{1}{R_3}+\frac{1}{R_4}} = \frac{\frac{12}{10^3} - 6{,}323\cdot 10^{-3}}{\frac{1}{10^3}+\frac{1}{10^3}} = \underline{2{,}8385\,V}$$

$$v_4(t) = v_4(\infty) + [v_4(0) - v_4(\infty)]\cdot e^{-t/\tau} = \underline{v_4(0)\cdot e^{-\frac{t}{\tau}}}.$$

(2)



$$v_{BB}(t) = \frac{10}{10^{-3}} t \; ; \; 0 < t < 1\,ms$$

$$V_{BB}(t_1) = V_{BE} \Rightarrow \frac{10}{10^{-3}} t = 0{,}7$$

$$t_1 = \frac{0{,}7}{10^4} = \underline{70\,\mu s}$$

$$I_B = \frac{V_{BB} - V_{BE}}{R_1}$$

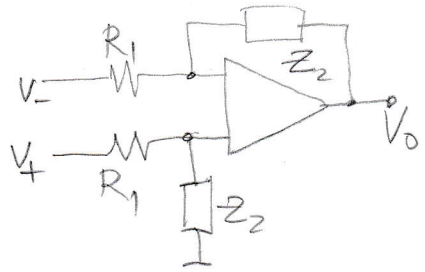
$$I_{B2} = \frac{V_2 - V_{BE}}{R_1}$$

$$V_{CE} = 12 - R_2 I_C = 12 - R_2 \beta I_B$$

$$V_{CEsat} = 12 - R_2 \beta I_{B2} \Rightarrow I_{B2} = \frac{12 - V_{CEsat}}{\beta R_2} = \frac{12 - 0{,}2}{150 \cdot 10^3} = 78{,}7\,\mu A$$

$$V_2 = V_{BE} + I_{B2} \cdot R_1 = 0{,}7 + 78{,}7 \cdot 10^{-6} \cdot 10^5 = \underline{8{,}57\,V} \; ; \; \underline{V_2 < 10}\,!$$

(3)

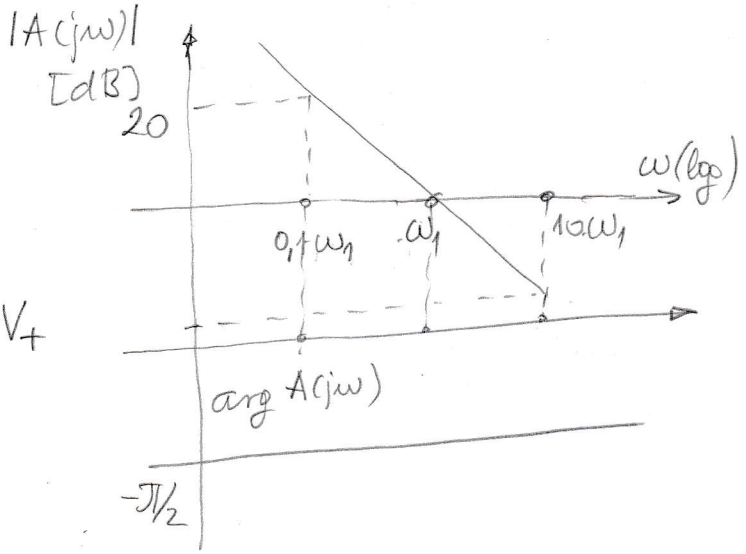


$$V_o = -V_- \cdot \frac{Z_2}{R_1} + \frac{Z_2}{R_1 + Z_2} \cdot \left(1 + \frac{Z_2}{R_1}\right) V_+$$

$$V_o = (V_+ - V_-) \cdot \frac{Z_2}{R_1}$$

$$Z_2 = \frac{1}{j\omega C_2}$$

$$A(j\omega) = \frac{V_o}{V_+ - V_-} = \frac{Z_2}{R_1} = \frac{1}{j\omega C_2 R_1} = \frac{1}{j \frac{\omega}{\omega_1}} = \frac{1}{j \cdot \frac{f}{f_1}}$$



$$\omega_1 = \frac{1}{C_2 R_1} \; ; \; f_1 = \frac{1}{2\pi C_2 R_1}$$

$$A(j\omega_1) = 1 \Rightarrow C_2 = \frac{1}{2\pi f R_1} = \frac{1}{2\pi \cdot 10^3 \cdot 10^4} = \underline{15{,}9\,nF}$$