(1) a)

$i_D = 200mA \qquad v_D = ?$

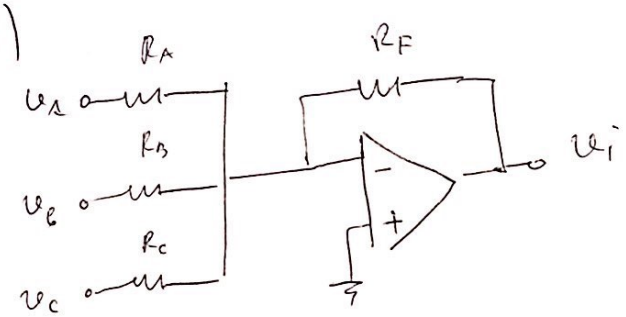
$$i_D = I_S\left(e^{\frac{v_D}{V_t}} - 1\right)$$

$$e^{\frac{v_D}{V_t}} = \frac{i_D}{I_S} + 1 \quad / \ln$$

$$\frac{v_D}{V_t} = \ln\left(\frac{i_D}{I_S} + 1\right) \qquad v_D = V_t \ln\left(\frac{i_D}{I_S} + 1\right)$$

$$v_D = 0{,}823\ V$$

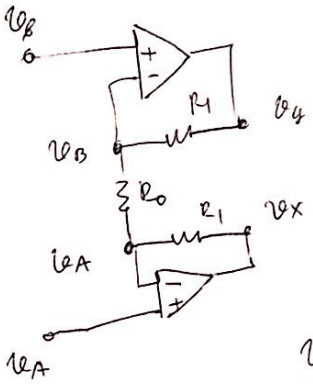
b)



$$\frac{v_A}{R_A} + \frac{v_B}{R_B} + \frac{v_C}{R_C} = -\frac{v_i}{R_F}$$

$$v_i = -\left(\frac{R_F}{R_A}v_A + \frac{R_F}{R_B}v_B + \frac{R_F}{R_C}v_C\right)$$

$R_A = 15k\Omega \quad R_B = 5k\Omega \quad R_C = 3k\Omega$



$$\frac{v_y - v_B}{R_1} = \frac{v_B - v_A}{R_0}$$

$$v_y - v_B = \frac{R_1}{R_0}v_B - \frac{R_1}{R_0}v_A$$

$$v_y = \left(\frac{R_1}{R_0} + 1\right)v_B - \frac{R_1}{R_0}v_A$$

$$\left(\frac{2R}{R_0} + 1\right) = 10$$

$$\frac{2R}{R_0} = 9$$

$$R_0 = \frac{2}{9}R$$

$R_0 = 2{,}22k\Omega$

$$\frac{v_6 - v_A}{R_0} = \frac{v_A - v_x}{R_1}$$

$$\frac{v_x - v_A}{R_1} = \frac{v_A - v_B}{R_0} \qquad v_x - v_A = \frac{R_1}{R_0}v_A - \frac{R_1}{R_0}v_B$$

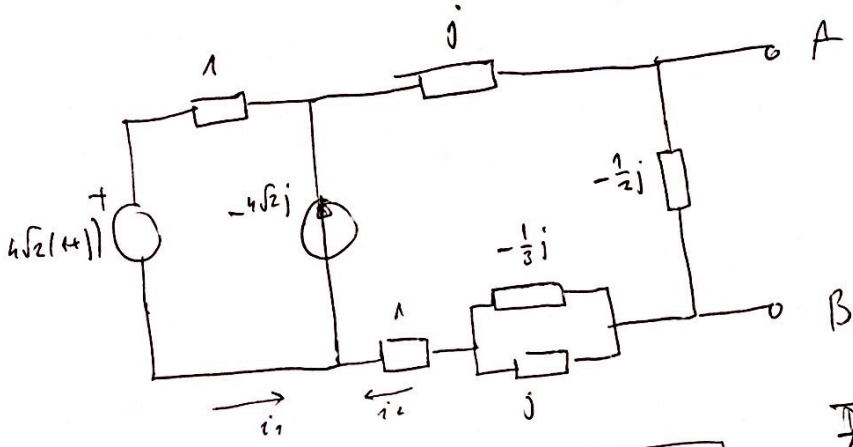
$$v_x = \left(\frac{R_1}{R_0} + 1\right)v_A - \frac{R_1}{R_0}v_B$$

$$v_i = \frac{R_3}{R_2}(v_x - v_y) = \frac{R_3}{R_2}\left(\left(\frac{R_1}{R_0}+1\right)v_A - \frac{R_1}{R_0}v_D - \left(\frac{R_1}{R_0}+1\right)v_6 + \frac{R_1}{R_0}v_A\right)$$

$$= \frac{R_3}{R_2}\left(\left(\frac{2R_1}{R_0}+1\right)v_A - \left(\frac{2R_1}{R_0}+1\right)v_B\right) = \underbrace{\frac{R_3}{R_2}\left(\frac{2R_1}{R_0}+1\right)}_{a}(v_A - v_B)$$

$\underline{U_6} = 8\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}j\right) = 4\sqrt{2}(1+j)$ $\quad \frac{8}{\sqrt{2}} = \frac{8\sqrt{2}}{2} = 4\sqrt{2}$

$I_6 = -4\sqrt{2}j$



$U_{TEV} =$

$\frac{-\frac{1}{3}j \cdot j}{\frac{2}{3}j} = \frac{\frac{1}{3}}{\frac{2}{3}j} \cdot \frac{j}{j} = \boxed{-\frac{1}{2}j}$

$\left(2 + \frac{j}{2}\right) \| \left(\frac{1}{2}j\right) =$

$i_2\left(1 - \frac{1}{2}j - \frac{1}{2}j + j\right) - i_1 = 4\sqrt{2}(1+j)$

$i_2 - i_1 = 4\sqrt{2} + 4\sqrt{2}j$

KHS $\boxed{i_1 + i_2 = -4\sqrt{2}j}$

$i_1 + i_2 = -4\sqrt{2}j$

$2i_2 = 4\sqrt{2} \quad \boxed{i_2 = 2\sqrt{2}}$

$\boxed{U_T = -\frac{1}{2}j \cdot 2\sqrt{2} = -j\sqrt{2}}$

$\frac{\left(2 + \frac{j}{2}\right) \cdot \left(-\frac{1}{2}j\right)}{2 + \frac{j}{2} - \frac{1}{2}j} = \frac{-j + \frac{1}{4}}{2} = \underbrace{-\frac{1}{2}j + \frac{1}{8}}_{Z_t}$

$\left(2 + \frac{j}{2}\right) \| \left(-\frac{j}{2}\right) = \frac{\left(2 + \frac{j}{2}\right)\left(-\frac{j}{2}\right)}{2}$

$u_t(t) = 2\sin(\omega t)$

$R_t = \frac{1}{8}\Omega \quad C_t = 0{,}2\,mF$

$Z_p = \frac{1}{8} + \frac{1}{2}j$

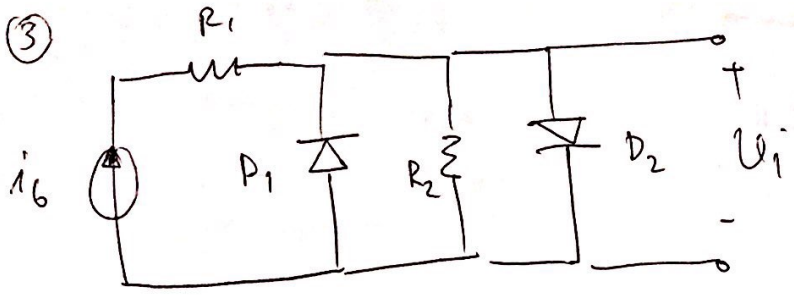
$\frac{-j\sqrt{2}}{\frac{1}{4}} = -4\sqrt{2}j = i_t$

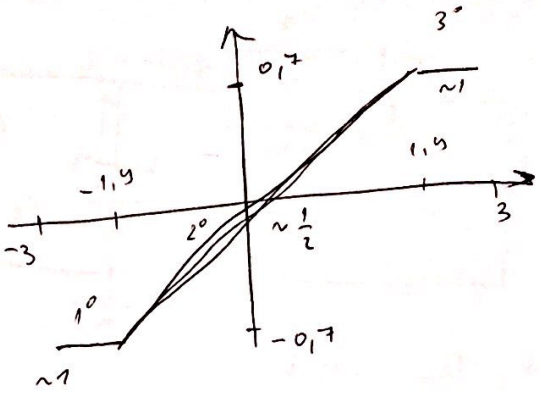
$\boxed{i_t(t) = 8\sin \omega t}$

$\boxed{32}$

$\frac{32}{8} + 16j$

③





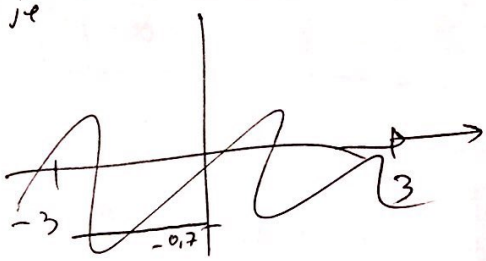
Za $i_g = -3\,mA$

D_1: ON , D_2: OFF

$v_{D2} = -0{,}7V$ OFF je

$$v_i = -V_D = -0{,}7V \quad \boxed{1^\circ}$$

$i_g \in (-3, -1{,}4)$



$i_{R2} = -1{,}4\,mA$

$i_{D1} = -i_g + i_{R2} = -i_g - 1{,}4\,mA > 0$

Za $i_g = -1{,}4\,mA$ $D_1 \rightarrow$ OFF

$$v_i = i_g R_2 \quad \boxed{2^\circ}$$

$i_g \in (-1{,}4, 1{,}4)$

Za $i_g R_2 = v_D$

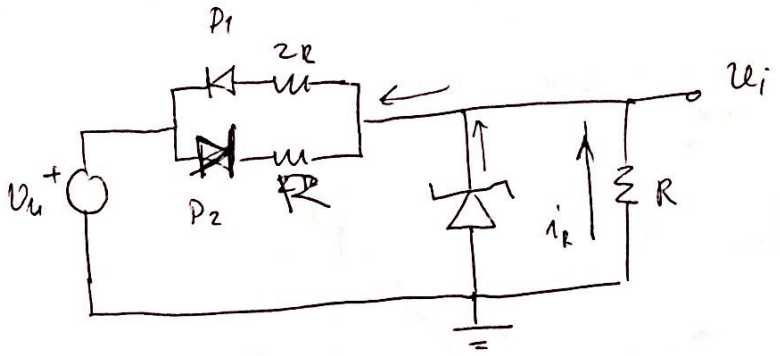
Za $i_g = 1{,}4\,mA$ $D_2 \rightarrow$ ON

$$v_i = V_D = 0{,}7V \quad \boxed{3^\circ}$$

$i_g \in (1{,}4, 3)$

$i_{R2} = 1{,}4\,mA$ $i_{D2} = i_g - 1{,}4\,mA \rightarrow$

$v_{D1} = -0{,}7V$



$i_R + i_Z = i_{D1}$

$i_Z = i_{D1} - i_R$

Za $v_u = -10\,V$

DZ: ON, D_1: ON

$i_R = 0{,}6\,mA$

$v_i = -V_D = -0{,}6\,V$ | 1° | $v_g \in (-10, -2{,}4)$

$v_u + V_D + i_{D1} \cdot 3R = 0$

$i_{D1} = -\frac{v_u + V_D}{3R}$

$v_{D2} = v_u + 0{,}6\,V < 0$

$v_u + 0{,}6 + i_{D1} 2R + 0{,}6 = 0$

$i_{D1} = -\frac{v_u + 1{,}2\,V}{2R}$

$i_Z = -\frac{v_u}{2} - 1{,}2\,mA$

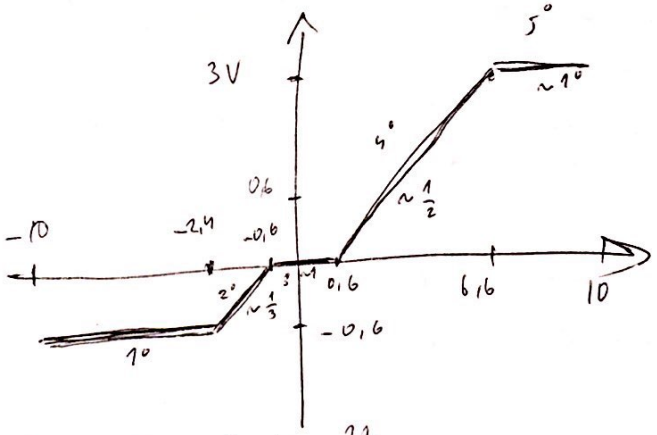
$v_i = +\frac{1}{3} v_u + 0{,}2$ | 2° | $v_g \in (-2{,}4, -0{,}6)$

$v_{D2} = v_u - v_i = v_u - \frac{1}{3} v_u - 0{,}2$

$v_{D2} = \frac{2}{3} v_u - 0{,}2$

Za $v_u = -2{,}4\,V$ DZ: OFF

$v_i = 0$ | 3° | $v_g \in (-0{,}6, 0{,}6)$



Za $v_g = 0{,}6\,V$ D_2 → ON

$v_u + V_D - i_{D2} 2R = 0$

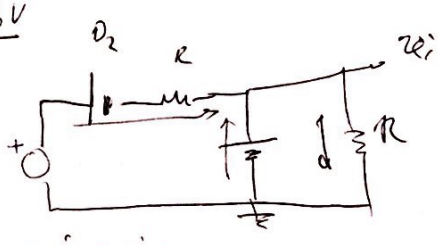
$i_{D2} = \frac{v_u - V_D}{2R}$ ↗

$V_Z + V_D + i_{D2} R = v_g$

$i_{D2} = \frac{v_g - 3{,}6\,V}{R}$

$v_i = \frac{v_u}{2} - 0{,}3$ | 4°

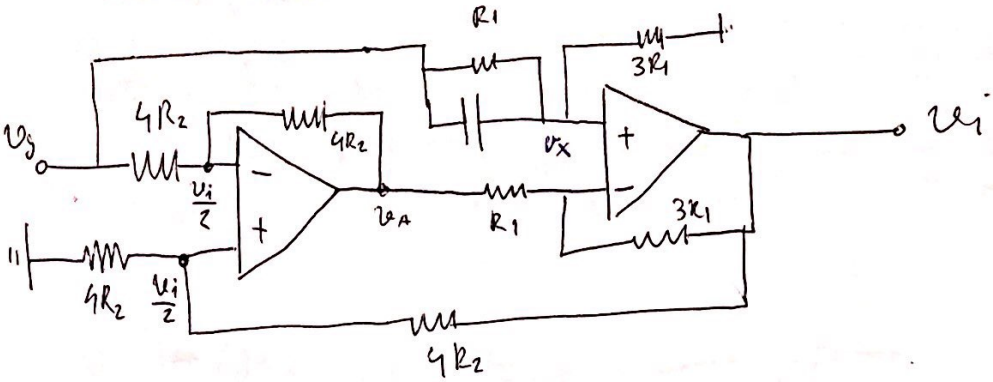
Za $v_i = 3V$ mi | $v_u = 6{,}6\,V$ D_Z → uvodj



$i_Z + i_D = i_R$

$v_i = 3V$ | 5°

$i_R = 3\,mA$ $i_Z = 3\,mA - \frac{v_g}{1k\Omega} + 3{,}6\,mA = 6{,}6\,mA - \frac{v_g}{1k\Omega}$



AC: $\frac{v_g - \frac{v_i}{2}}{4R_2} = \frac{\frac{v_i}{2} - v_A}{4R_2}$ $\quad v_A = v_i - v_g$

$\frac{v_A - v_g}{R_1} = \frac{v_g - v_i}{3R_1}$

$3v_i - 3v_g = v_g - v_i$

$4v_i = 5v_g$

$v_i = \frac{5}{4} v_g$ qc

$3v_A - 3v_g = v_g - v_i$

$v_i = 4v_g - 3v_A = 4v_g - 3v_i + 3v_g$

$4v_i = 7v_g$

$\boxed{v_i = \frac{7}{4} v_g}$

DC:

$v_A = v_i - v_g$

$\frac{v_g - v_x}{R_1} = \frac{v_x}{3R_1}$ $\qquad \frac{v_A - v_x}{R_1} = \frac{v_x - v_i}{3R_1}$

$v_g = \frac{4}{3} v_x$ $\quad \boxed{v_x = \frac{3}{4} v_g}$ $\qquad 3v_A - 3v_x = v_x - v_i$

$v_i = 4v_x - 3v_A = 3v_g - 3v_i + 3v_g$

$4v_i = 6v_g$ $\quad \boxed{v_i = \frac{3}{2} v_g}$

$v_i = 6m\,V - 14m\,V\cos(\omega t)$

$v_{Rg} = v_i - v_g$

$3v_g - 3v_g = v_g - v_i$

$3v_g = 4v_g - v_i$

$3v_i - 3v_g = 4v_g - v_i$

$v_i = \frac{7}{4} v_g$