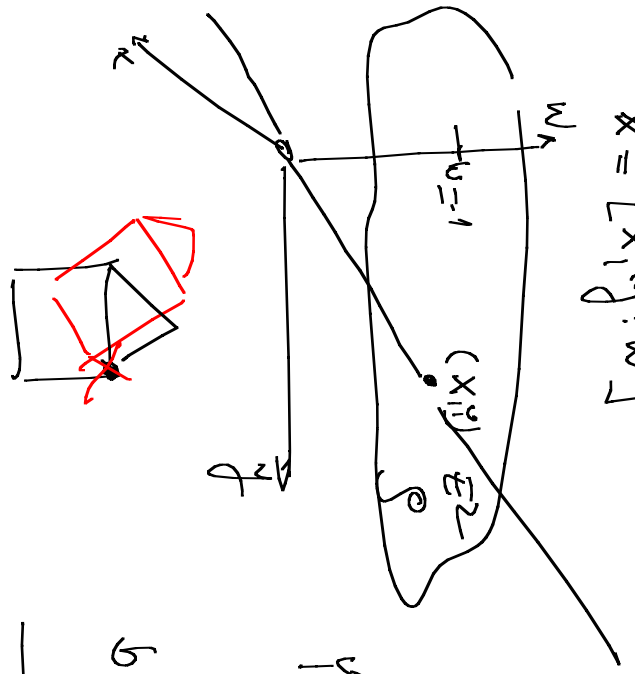


$$X = (x_1, y_1)$$

$$x = \frac{x}{w} \quad y = \frac{y}{w}$$

$$X = [x_1, y_1; w]$$



$$X_2 = X_1 + \Delta X$$

$$X_2 = R \cdot X_1$$

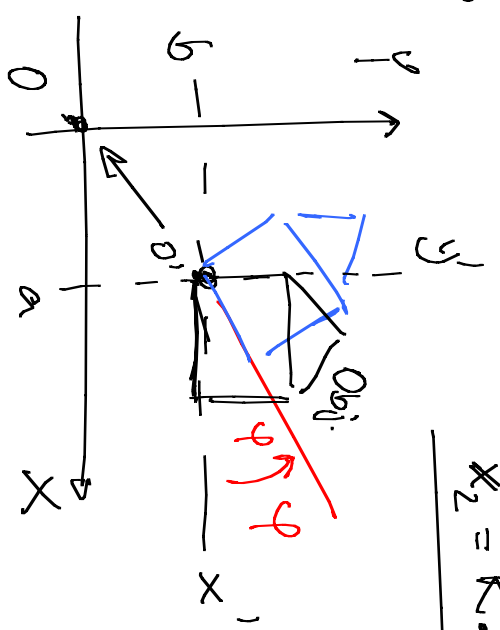
$$R = \begin{vmatrix} \cos \varphi & -\sin \varphi & 0 \\ \sin \varphi & \cos \varphi & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

$$X_2 = T \cdot X_1 \quad \text{posur}$$

$$X_2 = R \cdot X_1 \quad \text{rotax}$$

$$X' = T^{-1} \cdot R(\varphi) \cdot T \cdot X$$

↑  
# checking above step

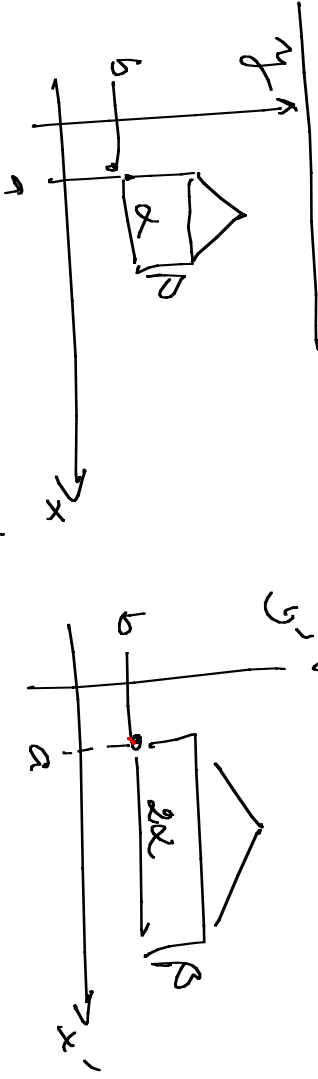


$$\begin{vmatrix} 1 & 0 & a \\ 0 & 1 & b \\ 0 & 0 & 1 \end{vmatrix} = T^{-1}$$

$$T(-a, -b)$$

$$\begin{vmatrix} 1 & 0 & -a \\ 0 & 1 & -b \\ 0 & 0 & 1 \end{vmatrix} = T$$

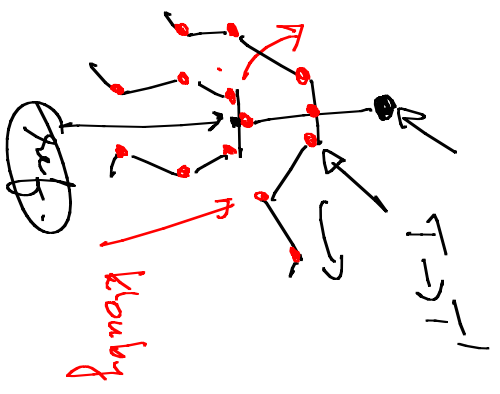
Zweiwertiges - Scaling



$$x' = T^{-1} S T x \quad \text{--- vordig skalen}$$

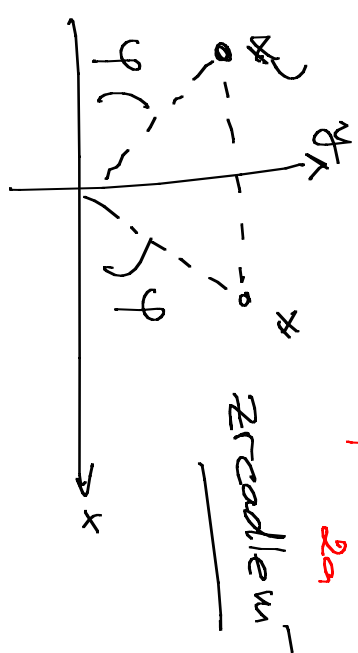
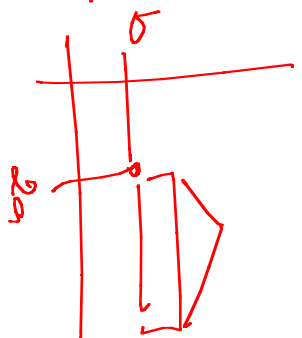
$$(-a_1 \ b)$$

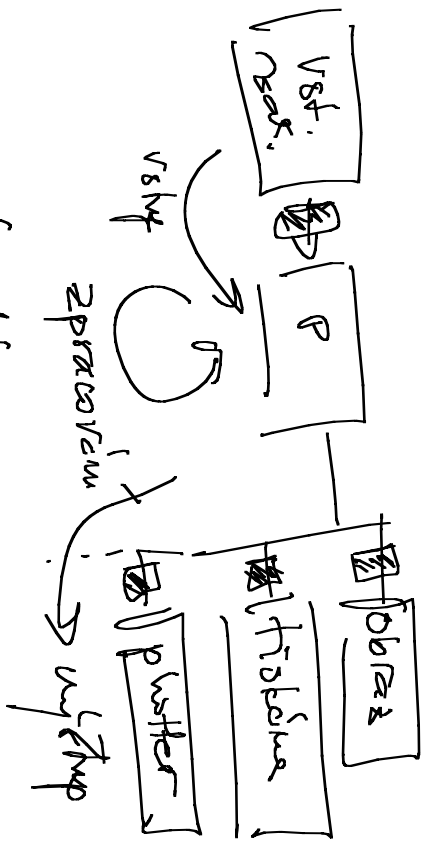
$\Rightarrow$  hierarchisches struktury



$$x' = \begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

??  $S_x = 2 \quad S_y = 1$





Source and systems

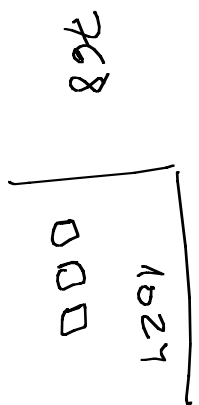
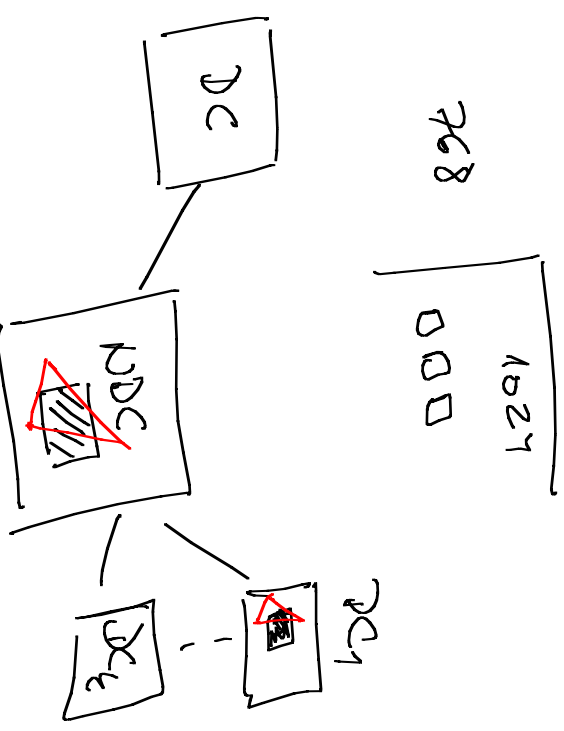
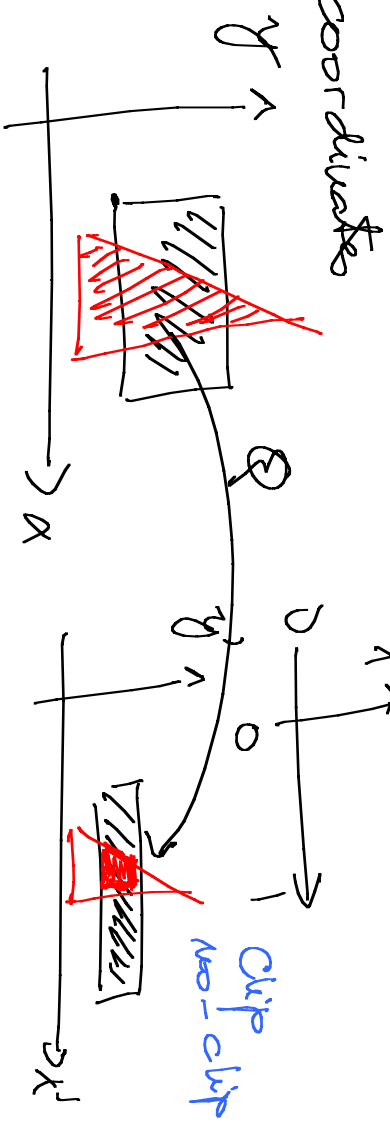
DC - - device coordinates

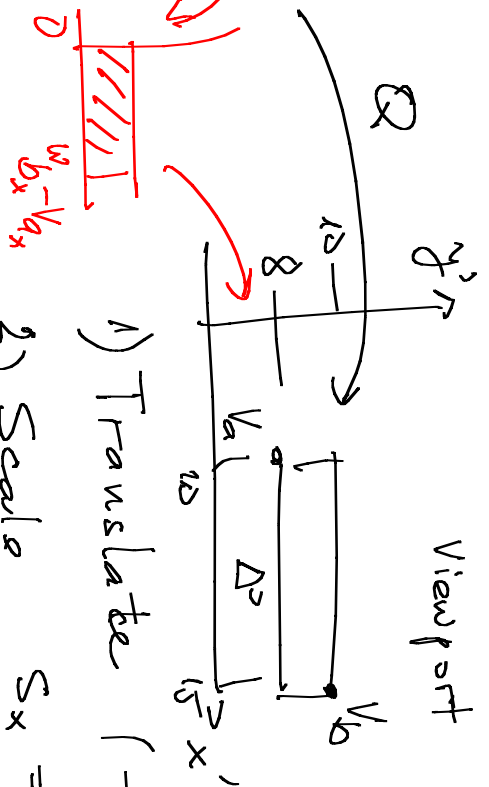
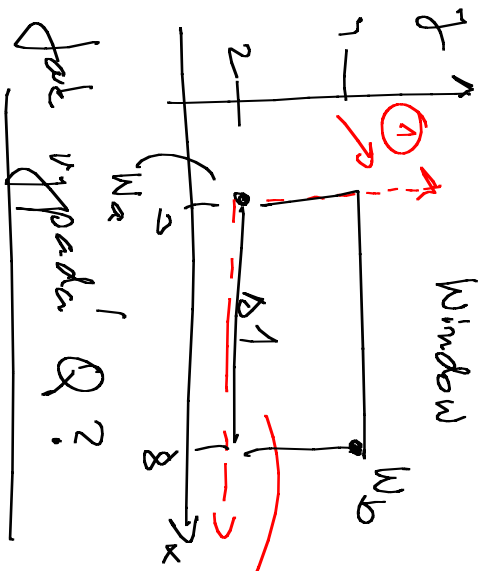
WC - - world coordinates

NDC - - normalized device coordinates

Transforms

Window - viewport





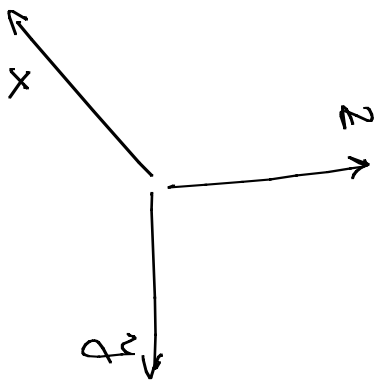
- 1) Translate  $(-W_{wx}, -W_{wy})$
- 2) Scale  $S_x = \frac{V_{bx} - V_{ax}}{W_{bx} - W_{ax}}$
- 3) Translate  $(V_{ax}, V_{ay})$

$$S_y = \frac{V_{by} - V_{ay}}{W_{by} - W_{ay}}$$

$$* = T_2 S T_1 *$$

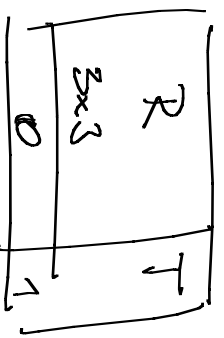
Q

E3

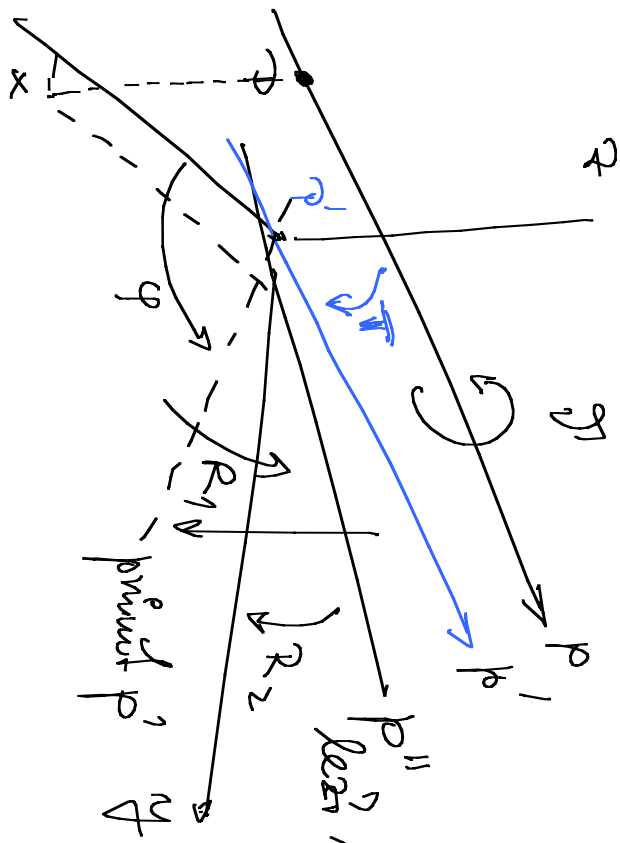


$$\Pi = \begin{vmatrix} 1 & 0 & 0 & \Delta x \\ 0 & 1 & 0 & \Delta y \\ 0 & 0 & 1 & \Delta z \\ 0 & 0 & 0 & 1 \end{vmatrix} \quad R_{xy} = \begin{vmatrix} \cos \varphi & -\sin \varphi & 0 & 0 \\ \sin \varphi & \cos \varphi & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

Q =



z-ach. geom. transf.



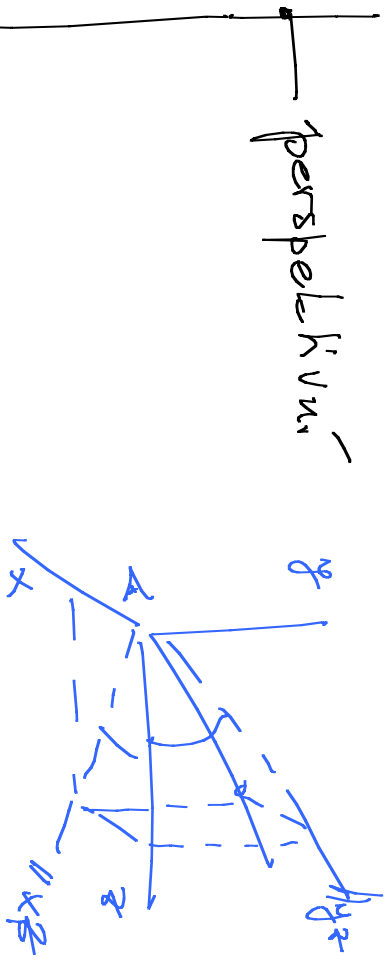
$$x' = \Pi x$$

$$\Pi = T^{-1} R_1^{-1} R_2^{-1} R(\varphi) R_2 R_1 \Pi x$$

$\Pi$  best  $\Pi x$

$E^3 \rightarrow E^2$  Průhlední - projekce

Rovinná projekce



paralelní

$$x' = P \cdot x$$

$$z' = d$$

$$\begin{pmatrix} x' \\ y' \\ z' \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/d & 0 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

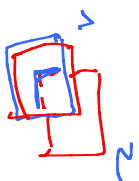
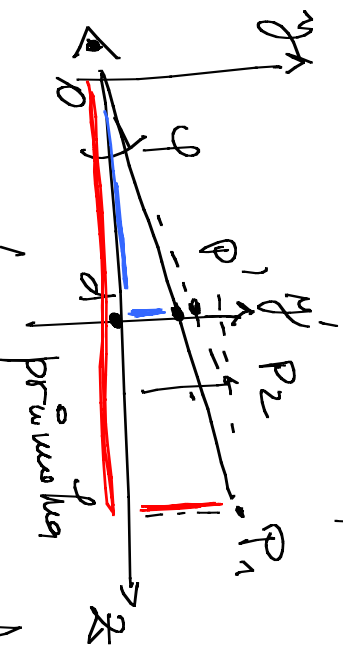
$z' = d$

$z' = d$

$z' = d$

Drs. Všeckého: Objektivní portace

SNTL, ~ 1975?



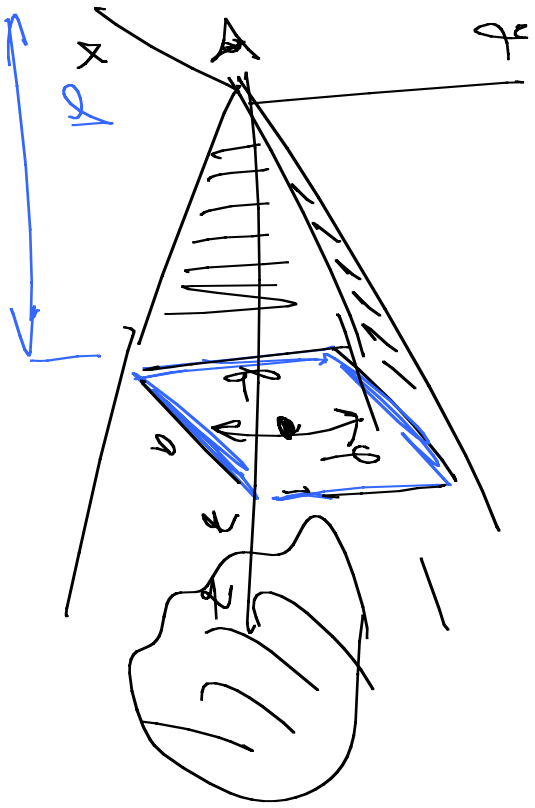
$$y' = \frac{y \cdot d}{z}$$

$$y' = y \cdot \frac{d}{z}$$

$$y' = y \cdot \frac{d}{z}$$

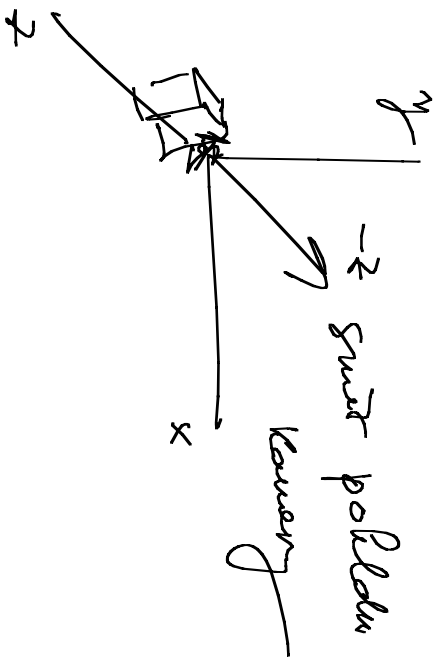
$$y' = \frac{y \cdot d}{z}$$





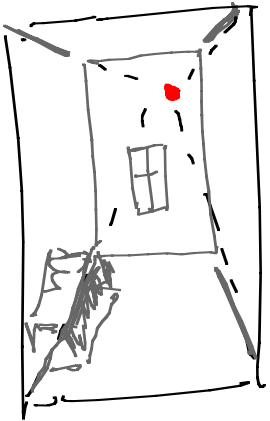
air

↳ Orientation system



# Perspektivi priekšas

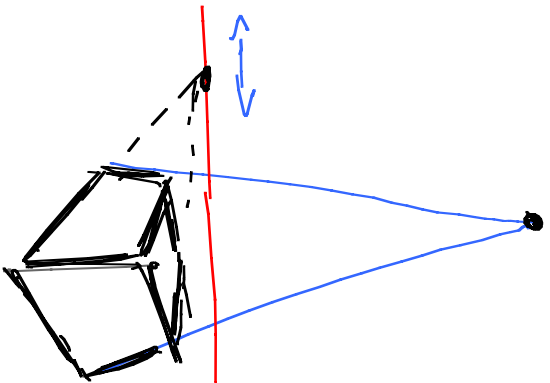
- jēkua uibe zini loms



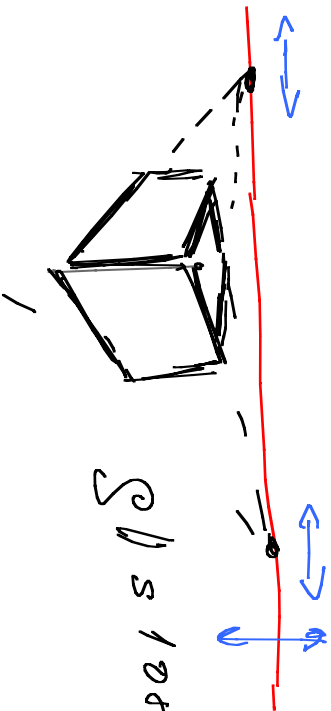
FTN uibe zini loms

- priekšas loms

208am



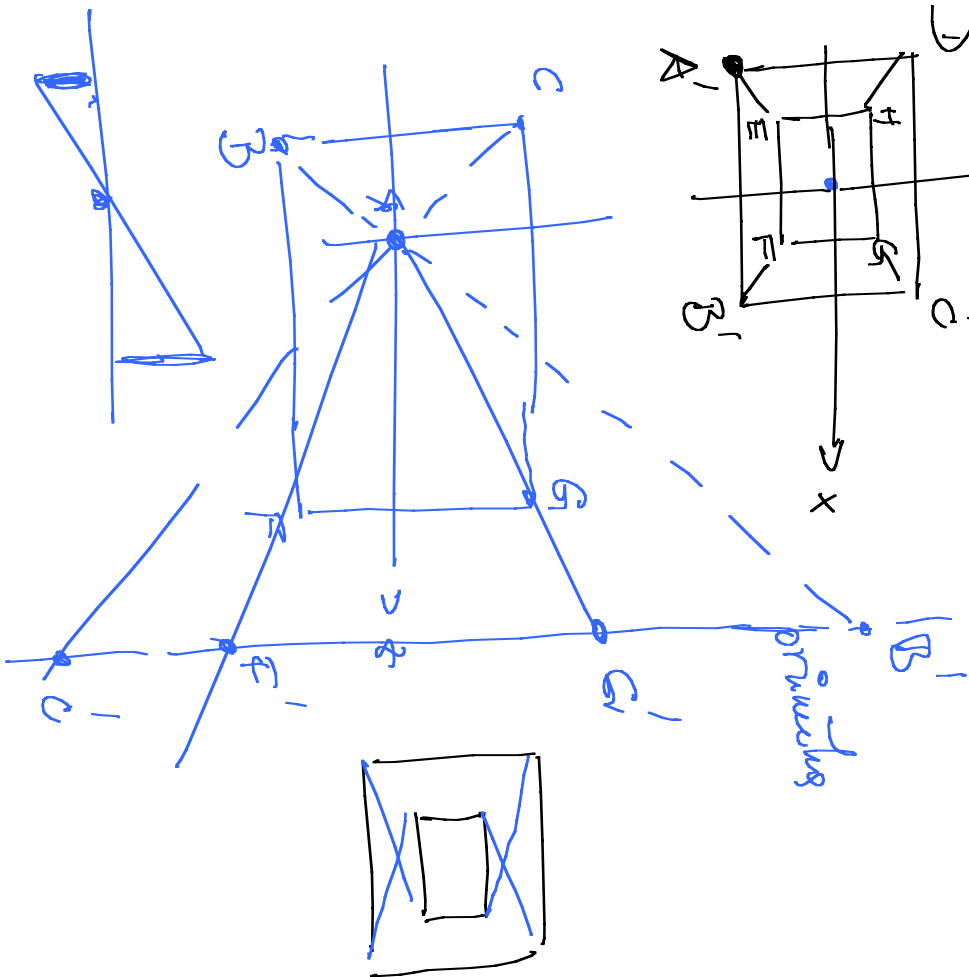
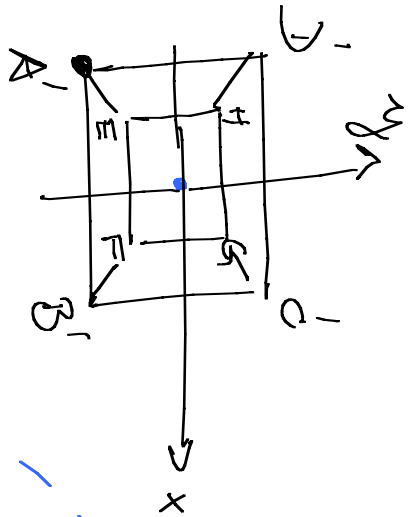
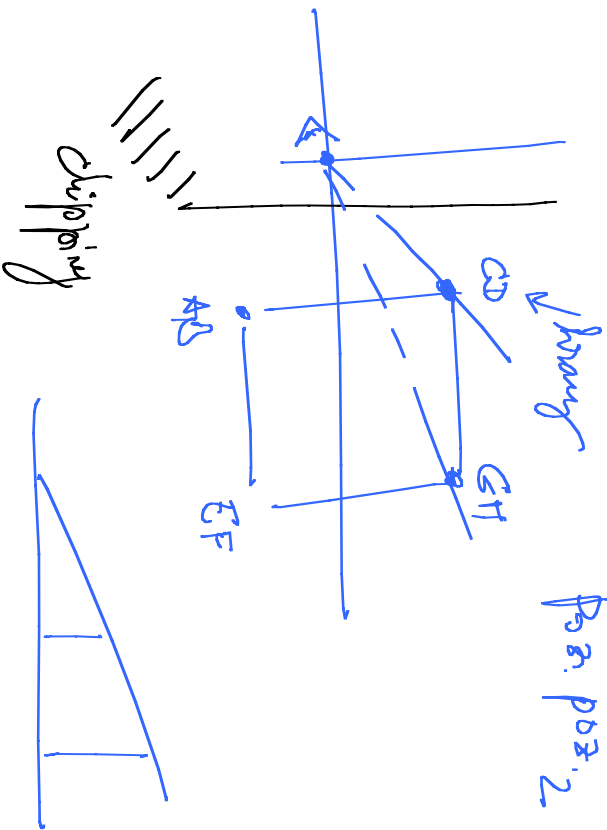
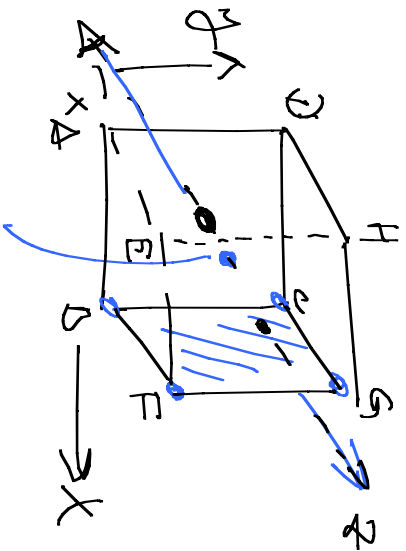
- draun uibe zini loms



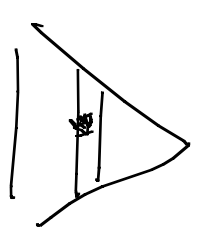
208am

Se kuru loms zini loms





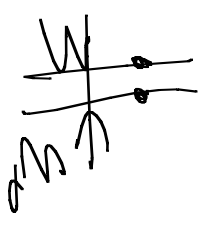
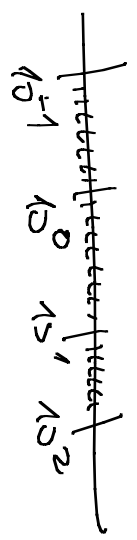
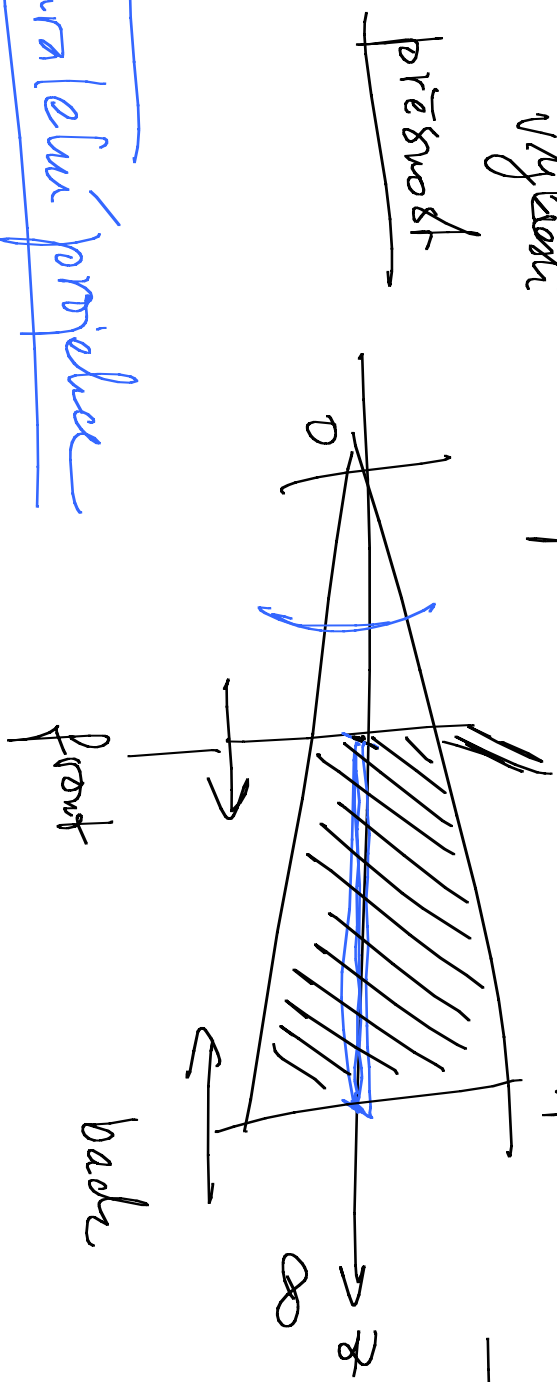
pixel  $(x, y, z)$



pseudo klatka



vykresli  
přesnost



parallelní projekce

Pohled