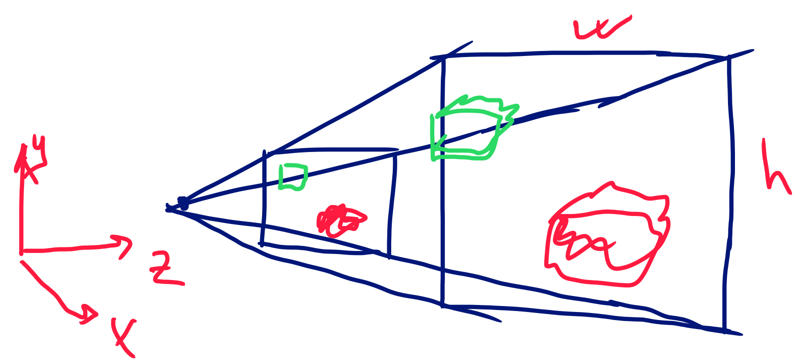
Perspective projection

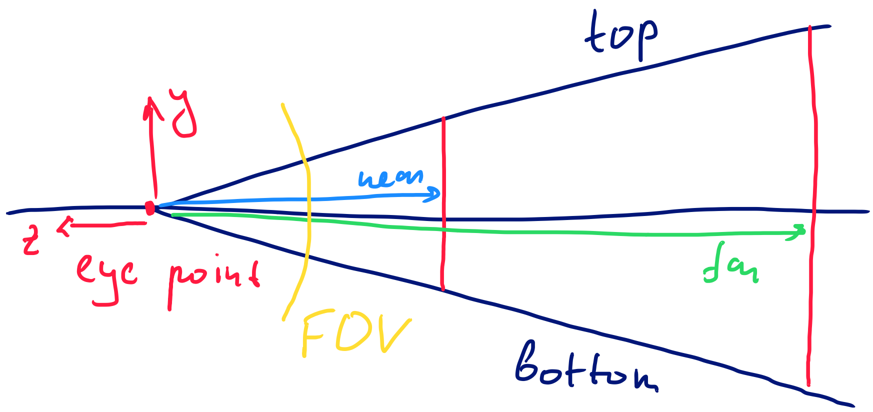
·) Aspect ratio (w x h) 4x3, 16x9 ·)
Field of view FOV
·) Normalization



The projection matrix and the view matrix describe completely different transformations.
The projection matrix describes the mapping from 3D points of a scene, to 2D points of the viewport.

The view matrix describes the direction and position from which the scene is looked at.

If the projection is perspective, then it will be possible to get the field of view angle and the aspect ratio from the projection matrix.



The Perspective Projection Matrix looks like

r = right, b = bottom, n = near,
l = left, t = top, f = far

w = width = $|r - l|$

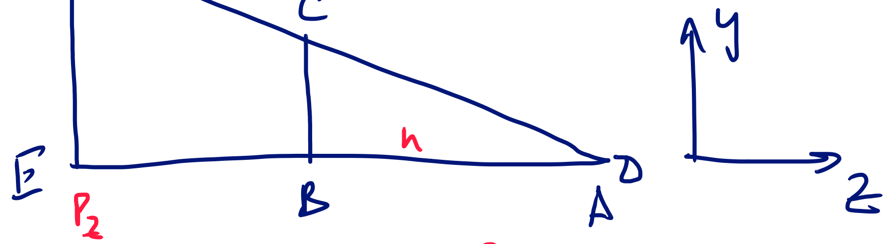
h = height = $|t - b|$

len = length = $|f - n|$

$$len = length = |f - n|$$

$$\begin{bmatrix} 2 \cdot n / w & 0 & 0 & 0 \\ 0 & 2 \cdot n / h & 0 & 0 \\ (r+l)/w & (t+b)/h & -(f+n)/len & -1 \\ 0 & 0 & -2 \cdot f \cdot n / len & 0 \end{bmatrix}$$

$$\frac{AB}{DE} = \frac{CB}{EF}$$



$$BC = P_{s_y} = \frac{n \cdot P_y}{-P_z}$$

αναλογως $P_{s_x} = \frac{n \cdot P_x}{-P_z}$

$l \le P_{s} \le r$

Пусть $l \le P_{sx} \le 2$ найти P_{sx} - ? так, чтобы $-1 \le \sim \le 1$

$$0 \le P_{sx} - l \le 2 - l$$

$$0 \le \frac{P_{sx} - l}{2 - l} \le 1$$

$$0 \le 2\frac{P_{sx} - l}{2 - l} \le 2 \qquad -1 \le \frac{2 \cdot P_{sx} - l - 2}{2 - l} \le 1$$

Далее, получим $-1 \le \dfrac{2nP_x}{-P_z(2-l)} - \dfrac{2+l}{2-l} \le 1$

$$\begin{pmatrix} \frac{2n}{2-l} & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ \frac{2+l}{2-l} & 0 & 1 & -1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

масштаб

$$\begin{bmatrix} x\\ y\\ z\\ 1\end{bmatrix}^T \begin{bmatrix}1&0&0&0\\ 0&1&0&0\\ 0&0&-\frac{f}{f-n}&-1\\ 0&0&-\frac{f\cdot n}{f-n}&0\end{bmatrix} = \begin{bmatrix} x/-z \\ y/-z \\ -\frac{f\cdot z}{f-n} - \frac{f\cdot n}{f-n} \\ -z\end{bmatrix} : (-z)$$

смещение по оси Z

$$z' = \frac{f\left(1+\frac{n}{z}\right)}{f-n}$$

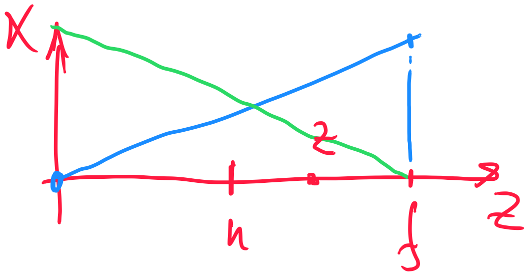
$$-\frac{1}{f} = z_c$$

$$z_c = -\frac{1}{f}$$

$$z'\left(-\frac{f-n}{f}\right) = \frac{z+n}{z} \left(-\frac{f}{f-n}\right)$$

$$z = \frac{-f\cdot n - f + n}{f} = -n + 1 + \frac{n}{f}$$

X



$$0 \le z' \le 1$$

$$n \le z \le f$$

$$0 \le z - n \le f - n$$

$$\frac{-f(z+n)}{f-n} \Big/ z$$

$$0 \le \frac{z-n}{f-n} \le 1 \qquad \frac{z}{f-n} - \frac{n}{f-n}$$

И можно еще проверить

$$-1 \le 2\left(\frac{z-n}{f-n}\right) - 1 \le 1$$

$$-1 \le \frac{2z - 2n - f + n}{f-n} \le 1$$

$$-1 \le -\frac{-2z + f + n}{f-n} \le 1$$