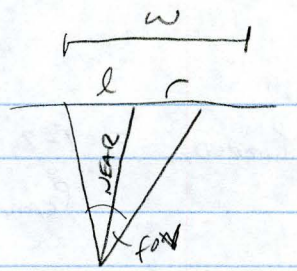


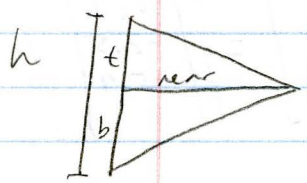
5. $n = 1$ $f = 100$ $fov_h = 30°$ ASPECT RATIO = 1:2

$\tan\left(\frac{fov}{2}\right) = \frac{r}{near}$ $\quad r = \tan(15) = 0.268$

$l = -r = -0.268$

WIDTH OF IM. PLANE @ NEAR $\quad w = 2 \cdot r = 0.5356$

HEIGHT @ NEAR $\quad \frac{w}{h} = \text{RATIO} = \frac{1}{2} \quad h = 2 \cdot 0.5356 = 1.0712$



$t = \frac{h}{2} = 0.5356$

$b = -t = -0.5356$

$$M_{proj} = \begin{bmatrix} \frac{2n}{r-l} & 0 & \frac{l+r}{l-r} & 0 \\ 0 & \frac{2n}{t-b} & \frac{b+t}{b-t} & 0 \\ 0 & 0 & \frac{n+f}{n-f} & \frac{-2fn}{n-f} \\ 0 & 0 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 3.734 & 0 & 0 & 0 \\ 0 & 1.867 & 0 & 0 \\ 0 & 0 & -1.02 & 2.02 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

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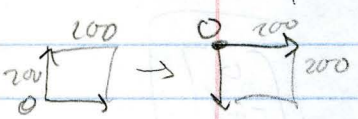
6. 200 pixels wide / 200 pixels high ORIGIN UPPER LEFT



$n_x = 200$

$n_y = 200$

$$M_{VP} = \underbrace{\begin{bmatrix} 1 & 0 & 0 & \frac{n_x-1}{2} \\ 0 & 1 & 0 & \frac{n_y-1}{2} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}}_{\text{TRANSLATION}} \underbrace{\begin{bmatrix} \frac{n_x}{2} & 0 & 0 & 0 \\ 0 & \frac{n_y}{2} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}}_{\text{SCALING}} * \rightarrow$$

$$\rightarrow * \underbrace{\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}}_{\text{REFLECTION}} = \begin{bmatrix} 100 & 0 & 0 & 99.5 \\ 0 & -100 & 0 & 99.5 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

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7. a) $P_{WORLD,a} = (3,2,1,1)^T$ $\quad P_{cam} = M_{cam}^{-1} P_{WORLD}$

$$P_{cam,a} = \begin{bmatrix} -0.51 & 0.51 & -0.69 & -2.1 \\ -0.75 & 0.13 & 0.65 & -1.75 \\ 0.42 & 0.85 & 0.32 & -10.28 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -3.3 \\ -3.1 \\ -7.0 \\ 1 \end{bmatrix}$$

b) $P_{WORLD,b} = (0,0,-3,1)^T$

$$P_{cam,b} = \begin{bmatrix} -0.51 & 0.51 & -0.69 & -2.1 \\ -0.75 & 0.13 & 0.65 & -1.75 \\ 0.42 & 0.85 & 0.32 & -10.28 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ -3 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ -3.7 \\ -11.2 \\ 1 \end{bmatrix}$$