\[ 0 = z \text{ and } y = y \text{ and } x = x \]

Orthogonal projection onto the xy plane:

Now let's do two simple projections:
So, larger z-buffer values correspond to larger distances from the viewer.

Ditto for Y BUT FOR Z use -depth and -near

normalizes it to the ] -1, +1[ range (the length of this range is 2.0).

\[
\frac{\text{ymax} - \text{ymin}}{2} \cdot 2 \left( \frac{2}{\text{ymax} + \text{ymin}} - x \right) \leftarrow \left( \frac{2}{\text{ymax} + \text{ymin}} - x \right)
\]

is the signed distance of \( x \) from middle of the desired view volume.

\[
\left( \frac{2}{\text{ymax} + \text{ymin}} - x \right) \leftarrow x
\]

Given (\( z', x', y' \)) viewing coordinates, how should we transform \( x \) be transformed?

exercise:

Let's implement \textsc{glortho} — use the math of your HW3 programming

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device coordinates with \( z_{\text{in}} = -1 \) (smallest value).

So, points in the near clipping plane \( +1 = z \) get transformed to normalized

\[
z_{-} = \frac{1}{z_{-}}
\]

perspectively divided at last, the result is

\[
(I, y', x') \quad \text{from the above used to transform}
\]

\[
[I] = [I] [\begin{array}{cc}
(I-1) & 0 \\
0 & \frac{(I-1)}{z-}
\end{array}] [I] [\begin{array}{cc}
\frac{u-f}{u+f} & \frac{u-f}{z-} \\
0 & \frac{q-q}{z}
\end{array}]
\]

When \( u = f \) and \( 1 - I = u \), the lower-right-hand \( 2 \times 2 \) matrix

\[
[I] = [I] [\begin{array}{cccc}
1 & 0 & 0 & 0 \\
\frac{u-f}{u+f} & \frac{u-f}{z} & 0 & 0 \\
\frac{q-1}{q+1} & 0 & \frac{q-1}{z} & 0 \\
\frac{1-u}{1+u} & 0 & 0 & \frac{1-u}{z}
\end{array}]
\]

From the RedBook, \( \text{SE}(3) \) generates

(\( f, l', u', t', n' \)')