Rotation Matrix:

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & \cos \theta & -\sin \theta \\
0 & \sin \theta & \cos \theta
\end{pmatrix}
\]

- Rotation around the \( x \)-axis anti-clockwise by angle of \( \theta \)

\[
\begin{pmatrix}
\cos \theta & 0 & -\sin \theta \\
0 & 1 & 0 \\
\sin \theta & 0 & \cos \theta
\end{pmatrix}
\]

- \( z \)-axis

Visualizing The Axes:

Unit Cube

A rotating anti-clockwise around the \( x \)-axis refers to anti-clockwise when looking directly into the "arrow" of the \( x \)-axis.
Reflectors in 3-dimensions

In 2 dimensions, matrix transformation matrices can be obtained by considering the points \( \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \)

and where their images are after the transformation \( \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \)

Planes

A plane is a flat surface with no boundaries

Plane \( x = 0 \)

Plane \( y = 0 \)
Use the basis \((\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}), (\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}), (\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix})\) to find the matrix that represents a reflection through the plane \(x = 0\).

\[
\begin{pmatrix}
-1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\]

represents a reflection through the plane \(x = 0\).
\[
\begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}
\] represents a reflection through \( y = 0 \)

\[
\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}
\] represents a reflection through \( z = 0 \)