π: $A\begin{pmatrix}1\\1\\1\end{pmatrix}$ $B\begin{pmatrix}3\\3\\3\end{pmatrix}$ $C\begin{pmatrix}1\\2\\3\end{pmatrix}$

$Q\begin{pmatrix}0\\1\\0\end{pmatrix}$

~~A~~ ~~B~~ $\begin{pmatrix}2\\2\\2\end{pmatrix}$

~~B~~ - C $\begin{pmatrix}2\\1\\3\end{pmatrix}$

n ?

d to the origin

d from Q to π

$$n = \begin{pmatrix}2\\2\\2\end{pmatrix} \times \begin{pmatrix}2\\1\\3\end{pmatrix} = \begin{pmatrix}-2\\4\\-2\end{pmatrix}$$

$|n| = 2\sqrt{6}$ $\quad \vec{n} = \frac{1}{\sqrt{6}}\begin{pmatrix}-1\\2\\-1\end{pmatrix}$

$\vec{n} \cdot (B - C) = 0$ $\quad P \in \pi \begin{pmatrix}x\\y\\3\end{pmatrix}$

$$\vec{n} \cdot (P - A) = 0$$

$$\frac{1}{\sqrt{6}} \begin{pmatrix} -1 \\ 2 \\ -1 \end{pmatrix} \cdot \begin{pmatrix} x-1 \\ y-1 \\ 3-1 \end{pmatrix} = 0$$

$$-\frac{1}{\sqrt{6}}x + \frac{2}{\sqrt{6}}y - \frac{1}{\sqrt{6}}3 = -\frac{1}{\sqrt{6}} + \frac{2}{\sqrt{6}} - \frac{1}{\sqrt{6}}$$

$$= 0$$

$$Q \begin{pmatrix} 0 \\ 1 \\ 3 \end{pmatrix} \quad q \begin{pmatrix} 0 \\ 1 \\ 3 \end{pmatrix} = Q - O \quad d \begin{pmatrix} 0 \\ 0 \\ 3 \end{pmatrix}$$

$$d_{Q \to \pi} = q \cdot \vec{n} - d$$

$$= q \cdot \vec{n} = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \cdot \frac{1}{\sqrt{6}} \begin{pmatrix} -1 \\ 2 \\ -1 \end{pmatrix} = \frac{2}{\sqrt{6}}$$

$\pi: x + y + z = 3 \qquad ax + by + cz = d$

$Q \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$

$$d_{Q \to \pi} = q \cdot n - d$$

$$n = \frac{1}{\sqrt{3}} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \qquad |n| = \sqrt{3}$$

$$\pi: \quad \frac{1}{\sqrt{3}} x + \frac{1}{\sqrt{3}} y + \frac{1}{\sqrt{3}} z = \underbrace{\sqrt{3}}_{d}$$

$$d_{Q \to \pi}: \quad \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \cdot \begin{pmatrix} 1/\sqrt{3} \\ 1/\sqrt{3} \\ 1/\sqrt{3} \end{pmatrix} - \sqrt{3} = \frac{1}{\sqrt{3}} - \sqrt{3}$$

$$\begin{bmatrix} s_x & 0 \\ 0 & s_y \end{bmatrix}^{-1} = \frac{1}{s_x s_y} \begin{bmatrix} s_y & 0 \\ 0 & s_x \end{bmatrix} = \begin{bmatrix} \frac{1}{s_x} & 0 \\ 0 & \frac{1}{s_y} \end{bmatrix}$$

$$T \begin{bmatrix} t_x \\ t_y \end{bmatrix} \qquad P' = I \begin{bmatrix} P_x \\ P_y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$$

$$= \begin{bmatrix} P_x + t_x \\ P_y + t_y \end{bmatrix} \qquad P \to P'$$

$$T^{-1} \qquad P' \to P \qquad \begin{bmatrix} -t_x \\ -t_y \end{bmatrix}$$

$P_x + t_x$ $\quad$ P_x

$P_y + t_y$ $\quad$ P_y