4.8.19

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Question

If the distance of the point $(1, 1, 1)$ from the plane $x - y + z + \lambda = 0$ is $\frac{5}{\sqrt{3}}$, find the value(s) of λ.

Solution

Equation of plane is given by

$$\mathbf{n}^\top \mathbf{x} = -\lambda; \tag{1}$$

where $\mathbf{n}^\top = \begin{pmatrix} 1 & -1 & 1 \end{pmatrix}$.

Solution

Let the distance of point P(1,1,1) from the plane is d.

$$d = \frac{||\mathbf{n}^\top \mathbf{P} + \lambda||}{||\mathbf{n}||} \tag{2}$$

then value of λ is given by

$$\lambda = +d||\mathbf{n}|| - \mathbf{n}^\top \mathbf{P} \text{ or} \tag{3}$$

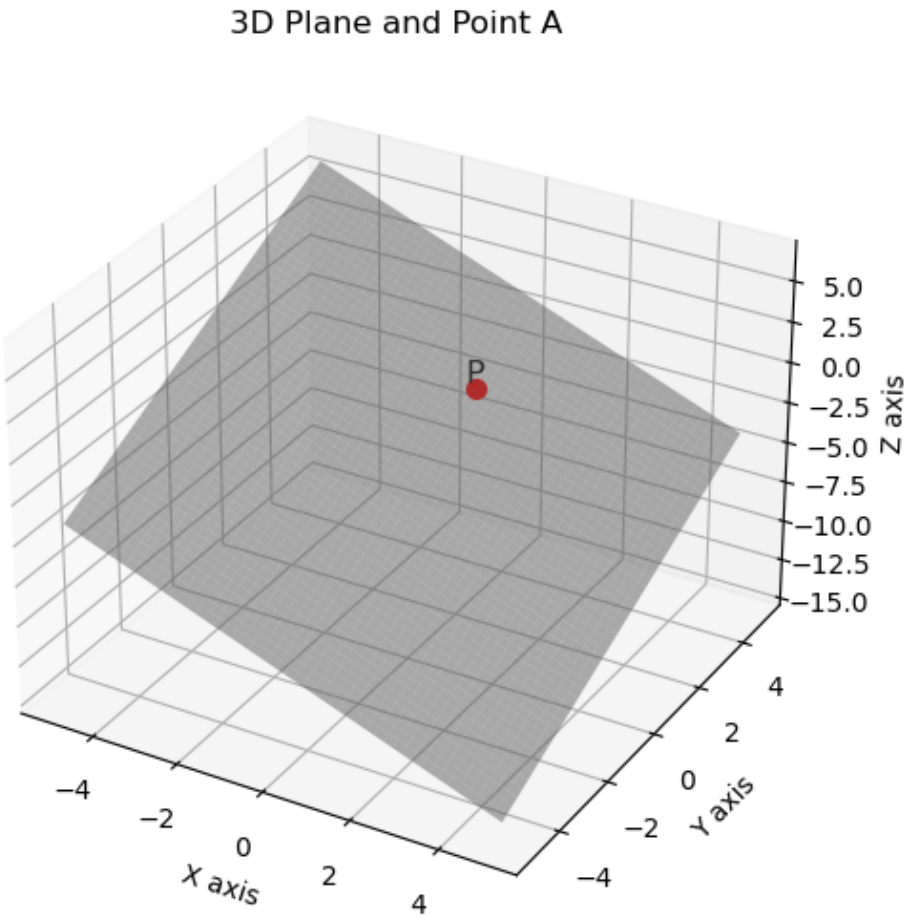
$$\lambda = -d||\mathbf{n}|| - \mathbf{n}^\top \mathbf{P} \tag{4}$$

Solving these Equations we get

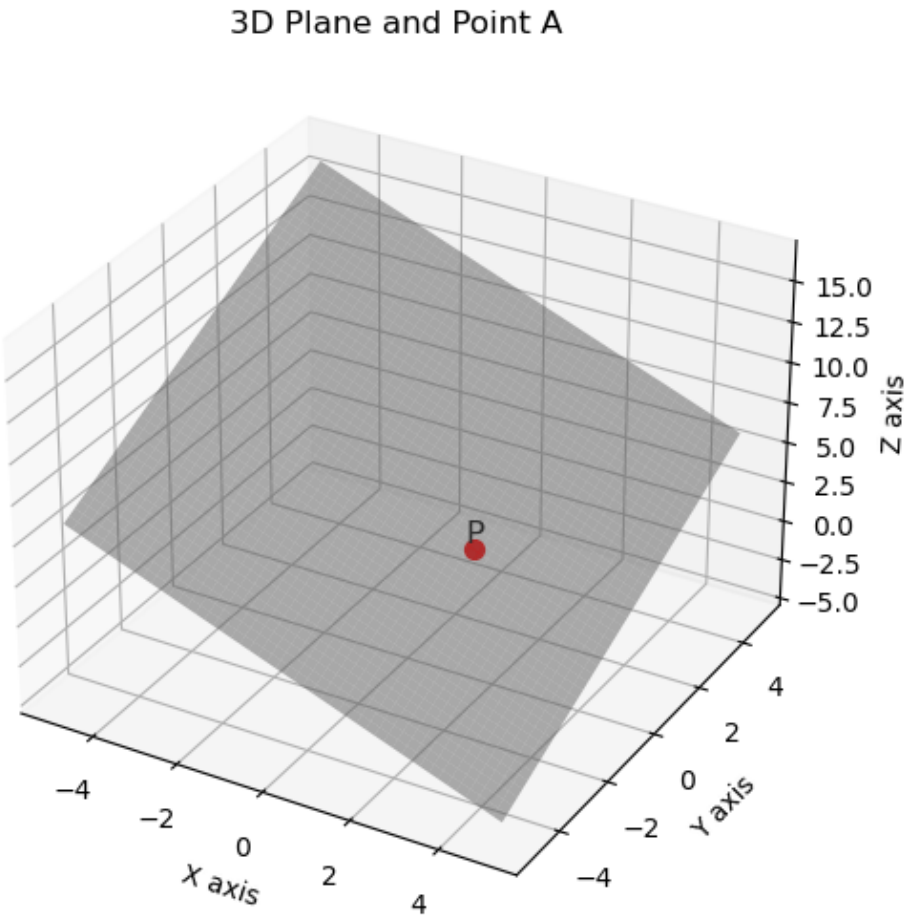
$$\implies \lambda = +4 \tag{5}$$

$$= -6 \tag{6}$$

plot


3D Plane and Point A
P
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
−12.5
−15.0
Z axis
−4
−2
0
2
4
X axis
4
2
0
−2
−4
Y axis

plot


3D Plane and Point A
P
15.0
12.5
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
Z axis
−4
−2
0
2
4
X axis
4
2
0
−2
−4
Y axis