4.8.23

AI25BTECH11027 - NAGA BHUVANA

Question:
Find the values of λ,for which the distance of point $(2, 1, \lambda)$ from plane $3x + 5y + 4z = 11$ is $2\sqrt{2}$ units.
Solution:
The normal vector of the plane is $\begin{pmatrix}3\\5\\4\end{pmatrix}$ and $\mathbf{P} = \begin{pmatrix}2\\1\\\lambda\end{pmatrix}$
The equation of the plane be $\mathbf{n}^T\mathbf{x} = c$

$$distance = \frac{|\mathbf{n}^T\mathbf{p} - 11|}{\|\mathbf{n}\|} \tag{1}$$

$$2\sqrt{2} = \frac{|\begin{pmatrix}3 & 5 & 4\end{pmatrix}\begin{pmatrix}2\\1\\\lambda\end{pmatrix} - 11|}{5\sqrt{2}} \tag{2}$$

$$\frac{|4\lambda|}{5\sqrt{2}} = 2\sqrt{2} \tag{3}$$

$$|4\lambda| = 20 \tag{4}$$

$$4\lambda = 20 \quad \text{or} \quad -4\lambda = -20 \tag{5}$$

$$\lambda = 5 \quad \text{or} \quad \lambda = -5 \tag{6}$$

$\therefore$The values of $\lambda = 5$ or -5

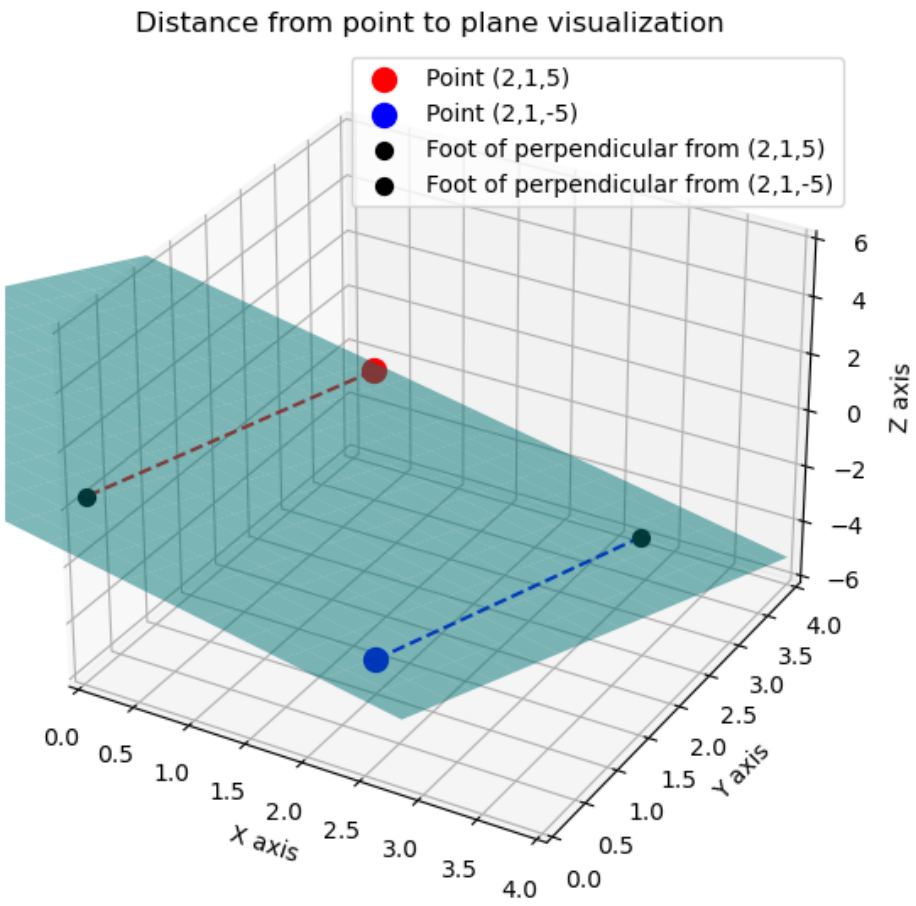
Distance from point to plane visualization
Point (2,1,5)
Point (2,1,-5)
Foot of perpendicular from (2,1,5)
Foot of perpendicular from (2,1,-5)
X axis
Y axis
Z axis
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
6
4
2
0
−2
−4
−6

Fig. 1