Assignment 2

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AI20MTECH11005

***Abstract*—This document finds the equation of a plane which is at a distance of 7 units from origin and normal to** $\begin{pmatrix}3\\5\\-6\end{pmatrix}$

Download all python codes from

https://github.com/Matish007/Matrix-Theory-EE5609-/tree/master/Assignment_2/codes

and latex-tikz codes from

https://github.com/Matish007/Matrix-Theory-EE5609-/tree/master/Assignment_2

1 Problem

Find the equation of a plane which is at a distance of 7 units from origin and normal to $\begin{pmatrix}3\\5\\-6\end{pmatrix}$

$\vec{n}=\begin{pmatrix}3\\5\\-6\end{pmatrix}$

2 Explanation

First calculate the unit vector of given normal vector.Then put it in the equation $\vec{n}^T\vec{x} = c$,where $\vec{n}^T$ is the unit normal vector we calculated and c is the distance from origin and $\vec{x}$ is a position vector of a point of the plane.

$$\vec{n} = \begin{pmatrix}3\\5\\-6\end{pmatrix} \tag{1}$$

$$\|\vec{n}\| = \sqrt{3^2+5^2+(-6)^2} = \sqrt{70} \tag{2}$$

$$\hat{n} = \frac{\vec{n}}{\|\vec{n}\|} \tag{3}$$

$$\hat{n} = \frac{1}{\sqrt{70}}\begin{pmatrix}3\\5\\-6\end{pmatrix} \tag{4}$$

$$c = 7 \tag{5}$$

$$\vec{n}^T\vec{x} = c \tag{6}$$

Substituting (4),(5) in (6) we get

$$\boxed{\begin{pmatrix}3 & 5 & -6\end{pmatrix}\vec{x} = 7\sqrt{70}} \tag{7}$$

Equation 7 gives us the equation of a plane which is at a distance of 7 units from origin and normal to $\begin{pmatrix}3\\5\\-6\end{pmatrix}$

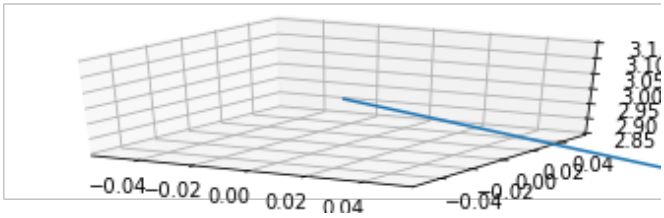

Fig. 1: Normal vector

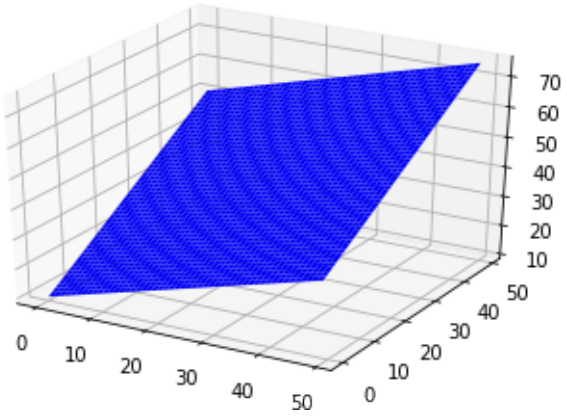

Fig. 2: Plane