Assignment 2

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***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 $\begin{pmatrix} 3 \\ 5 \\ -6 \end{pmatrix}$

$\boldsymbol{w}=\begin{pmatrix} 3 \\ 5 \\ -6 \end{pmatrix}$

2 Explanation

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

$$\boldsymbol{w} = \begin{pmatrix} 3 \\ 5 \\ -6 \end{pmatrix} \tag{1}$$

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

$$\boldsymbol{y} = \frac{\boldsymbol{w}}{\|\boldsymbol{w}\|} \tag{3}$$

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

$$\boldsymbol{D} = 7 \tag{5}$$

$$\boldsymbol{y}.\boldsymbol{x} = \boldsymbol{D} \tag{6}$$

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

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

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