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

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1 Problem

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

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

2 Explanation

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

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

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

$$\mathbf{n} = \frac{\mathbf{n}}{\|\mathbf{n}\|} \tag{3}$$

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

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

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

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

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

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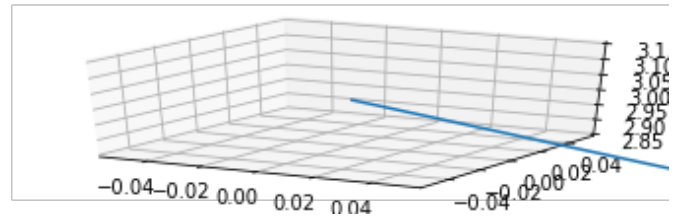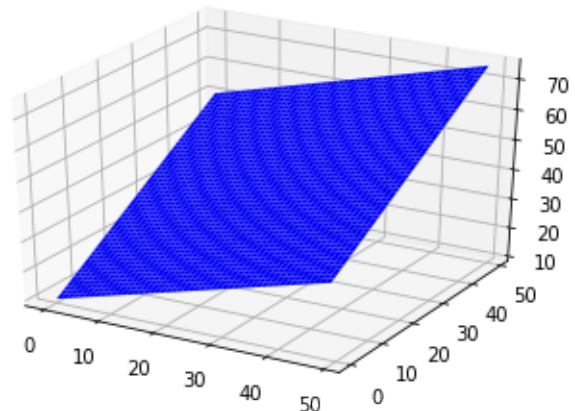

Fig. 1: Normal vector

Fig. 2: Plane