ASSIGNMENT 5

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Download all python codes from

https://github.com/ponnaboinakalpana12/ASSIGNMENT5/ASSIGNMENT5.py

and latex-tikz codes from

https://github.com/ponnaboinakalpana12/ASSIGNMENT5/ASSIGNMENT5.tex

1 Question No 2.43c

In the following case, determine whether the given planes are parallel or perpendicular, and in case they are neither, find the angle between them.

1) $\begin{pmatrix}2 & -2 & 4\end{pmatrix}\mathbf{x} = -5$ and $\begin{pmatrix}3 & -3 & 6\end{pmatrix}\mathbf{x} = 1$

2 Solution:

Given the planes,

$$P_1 : \begin{pmatrix}2 & -2 & 4\end{pmatrix}\mathbf{x} = -5 \tag{2.0.1}$$

$$P_2 : \begin{pmatrix}3 & -3 & 6\end{pmatrix}\mathbf{x} = 1 \tag{2.0.2}$$

The normal vector of P_1 and P_2 are

$$\mathbf{n}_1 = \begin{pmatrix}2\\-2\\4\end{pmatrix} \tag{2.0.3}$$

and

$$\mathbf{n}_2 = \begin{pmatrix}3\\-3\\6\end{pmatrix}, \tag{2.0.4}$$

Now we will find out magnitudes of each vectors $\mathbf{n}_1$,$\mathbf{n}_2$:

$$\|\mathbf{n}_1\| = \sqrt{4+4+16} = \sqrt{24} \tag{2.0.5}$$

$$\|\mathbf{n}_2\| = \sqrt{9+9+36} = \sqrt{54} \tag{2.0.6}$$

Thus angle between 2 vectors $\mathbf{n}_1$,$\mathbf{n}_2$ can be found using dot-product using the formula below, Let θ be angle between vectors $\mathbf{n}_1$,$\mathbf{n}_2$ then,

$$\theta = \cos^{-1}\left(\frac{\mathbf{n}_1^T\mathbf{n}_2}{\|\mathbf{n_1}\|\,\|\mathbf{n_2}\|}\right) \tag{2.0.7}$$

By,Putting values into above equation we get,

$$\theta = \cos^{-1}\left(\frac{\begin{pmatrix}2 & -2 & 4\end{pmatrix}\begin{pmatrix}3\\-3\\6\end{pmatrix}}{\sqrt{24}\,\sqrt{54}}\right) \tag{2.0.8}$$

$$\theta = \cos^{-1}\left(\frac{36}{\sqrt{24}\,\sqrt{54}}\right) \tag{2.0.9}$$

$$= \cos^{-1}\left(\frac{36}{36}\right) \tag{2.0.10}$$

$$= \cos^{-1}(1) \tag{2.0.11}$$

$$\implies \theta = 0^\circ \tag{2.0.12}$$

The given planes are parallel.

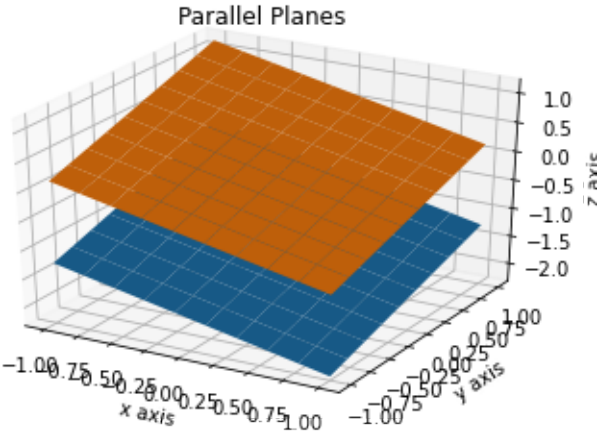

Fig. 2.1: Parallel planes