

ASSIGNMENT 7

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Download all python codes from

<https://github.com/Sowmyabandi99/Assignment7/blob/main/Assignment7/assignment7.py>

Latex-tikz codes from

<https://github.com/Sowmyabandi99/Assignment7/blob/main/Assignment7/main.tex>

Plot of the equation whose distance from the points A and B are equal-

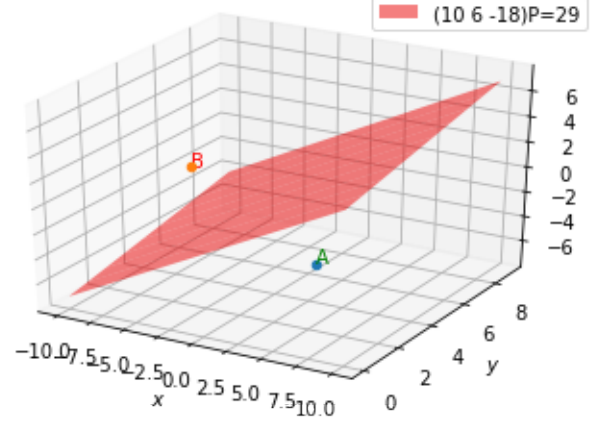


Fig. 2.1: Plot of the plane

1 QUESTION No 2.29

Find the equation of the set of points \mathbf{P} such that its distances from the points $\mathbf{A} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -2 \\ 1 \\ 4 \end{pmatrix}$ are equal.

2 SOLUTION

From the given information,

$$\|\mathbf{P} - \mathbf{A}\|^2 = \|\mathbf{P} - \mathbf{B}\|^2 \quad (2.0.1)$$

$$\Rightarrow \|\mathbf{P}\|^2 + \|\mathbf{A}\|^2 - 2\mathbf{A}^T \mathbf{P} \quad (2.0.2)$$

$$= \|\mathbf{P}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{B}^T \mathbf{P} \quad (2.0.3)$$

$$\Rightarrow 2\mathbf{A}^T \mathbf{P} - 2\mathbf{B}^T \mathbf{P} = \|\mathbf{A}\|^2 - \|\mathbf{B}\|^2 \quad (2.0.4)$$

Also given,

$$\mathbf{A} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -2 \\ 1 \\ 4 \end{pmatrix} \quad (2.0.5)$$

Putting (2.0.5) in (2.0.4), we get

$$2(3 \ 4 \ -5)\mathbf{P} - 2(-2 \ 1 \ 4)\mathbf{P} \quad (2.0.6)$$

$$= \left\| \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix} \right\|^2 - \left\| \begin{pmatrix} -2 \\ 1 \\ 4 \end{pmatrix} \right\|^2 \quad (2.0.7)$$

$$\Rightarrow (6 \ 8 \ -10)\mathbf{P} + (4 \ -2 \ -8)\mathbf{P} \quad (2.0.8)$$

$$= 50 - 21 \quad (2.0.9)$$

$$\Rightarrow (10 \ 6 \ -18)\mathbf{P} = 29 \quad (2.0.10)$$

\therefore The required equation is

$$(10 \ 6 \ -18)\mathbf{P} = 29 \quad (2.0.11)$$