

ASSIGNMENT-7

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Download all python codes from

<https://github.com/behappy0604/Summer-Internship-IITH/tree/main/Assignment-7>

and latex-tikz codes from

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$\Rightarrow \frac{\mathbf{A}+\mathbf{B}}{2}$ satisfies (2.0.2)

- \mathbf{x} is the plane that is perpendicular bisector of the line joining the given points

Putting given values \mathbf{A} and \mathbf{B} in (2.0.2), we get

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

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

1 QUESTION NO. 2.29
Find the equation of the set of points \mathbf{P} such that its distances from the points $\mathbf{A} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -2 \\ 1 \\ 4 \end{pmatrix}$ are equal.

$$\Rightarrow (6 \ 8 \ -10)\mathbf{x} + (4 \ -2 \ -8)\mathbf{x} = 50 - 21 \quad (2.0.8)$$

2 SOLUTION

$$\Rightarrow (10 \ 6 \ -18)\mathbf{x} = 29 \quad (2.0.9)$$

Let $\mathbf{P}=\mathbf{x}$

\therefore The required equation is

From the given information,

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

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

$$\Rightarrow 2\mathbf{A}^T\mathbf{x} - 2\mathbf{B}^T\mathbf{x} = \|\mathbf{A}\|^2 - \|\mathbf{B}\|^2 \quad (2.0.2)$$

The required figure for the above equation is as follows:

Equation of plane is $\mathbf{n}^T\mathbf{x} = \mathbf{d}$

where, \mathbf{n}^T is the normal vector to the plane

- From (2.0.2),

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

\mathbf{x} is a plane and it is perpendicular bisector of $\mathbf{A} - \mathbf{B}$

$\therefore \mathbf{x}$ is perpendicular to line joining \mathbf{A} and \mathbf{B}

- Midpoint of \mathbf{A} and \mathbf{B}

$$\mathbf{M} = \frac{\mathbf{A} + \mathbf{B}}{2} \quad (2.0.4)$$

- Substitute in (2.0.3),

$$\Rightarrow (2\mathbf{A}^T - 2\mathbf{B}^T)\left(\frac{\mathbf{A} + \mathbf{B}}{2}\right) = \|\mathbf{A}\|^2 - \|\mathbf{B}\|^2 \quad (2.0.5)$$

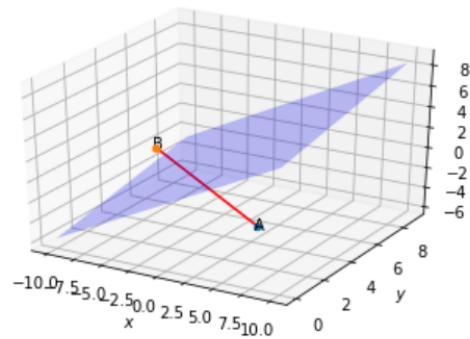


Fig. 0: Plane bisecting Line