

# ASSIGNMENT 7

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Download all python codes from

<https://github.com/Atlakeerthana/Assignment7/tree/main/Assignment7>

and

and latex-tikz codes from

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$$(\mathbf{PB})^2 = \|\mathbf{P} - \mathbf{B}\|^2 \quad (2.0.7)$$

$$= \|\mathbf{X} - \mathbf{B}\|^2 \quad (2.0.8)$$

$$= \|\mathbf{X}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{X}^T \mathbf{B} \quad (2.0.9)$$

The given equation is

$$(\mathbf{PA})^2 + (\mathbf{PB})^2 = 2k^2 \quad (2.0.10)$$

Sub (2.0.6) and (2.0.9) values in (2.0.10)

$$\|\mathbf{X}\|^2 + \|\mathbf{A}\|^2 - 2\mathbf{X}^T \mathbf{A} + \|\mathbf{X}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{X}^T \mathbf{B} = 2k^2 \quad (2.0.11)$$

$$\Rightarrow 2\|\mathbf{X}\|^2 + \|\mathbf{A}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{X}^T (\mathbf{A} + \mathbf{B}) = 2k^2 \quad (2.0.12)$$

sub  $\mathbf{A}, \mathbf{B}$  values in equation (2.0.12), we get

$$2\|\mathbf{X}\|^2 + \left\| \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix} \right\|^2 + \left\| \begin{pmatrix} -1 \\ 3 \\ -7 \end{pmatrix} \right\|^2 - 2\mathbf{X}^T \left( \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix} + \begin{pmatrix} -1 \\ 3 \\ -7 \end{pmatrix} \right) = 2k^2 \quad (2.0.13)$$

$\therefore$  the required equation is

$$2\|\mathbf{X}\|^2 - 2\mathbf{X}^T \begin{pmatrix} 2 \\ 7 \\ -2 \end{pmatrix} + 109 - 2k^2 = 0 \quad (2.0.14)$$

## 1 QUESTION NO 2.25(VECTOR FORMS)

Find the equation of set of points  $\mathbf{P}$  such that

$$(\mathbf{PA})^2 + (\mathbf{PB})^2 = 2k^2; \quad (1.0.1)$$

$$\mathbf{A} = \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix}; \quad (1.0.2)$$

$$\mathbf{B} = \begin{pmatrix} -1 \\ 3 \\ -7 \end{pmatrix}; \quad (1.0.3)$$

respectively.

## 2 SOLUTION

Given ,

$$\mathbf{A} = \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix}; \quad (2.0.1)$$

$$\mathbf{B} = \begin{pmatrix} -1 \\ 3 \\ -7 \end{pmatrix}; \quad (2.0.2)$$

Let,

$$\mathbf{P} = \mathbf{X}; \quad (2.0.3)$$

so,

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

$$= \|\mathbf{X} - \mathbf{A}\|^2 \quad (2.0.5)$$

$$= \|\mathbf{X}\|^2 + \|\mathbf{A}\|^2 - 2\mathbf{X}^T \mathbf{A} \quad (2.0.6)$$