# Assignment 3

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Find Python Codes from below link

https://github.com/TGURUBALAJI/INTERNSHIP–IITH/tree/main/Assignment3

and latex-tikz codes from

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## 1 Examples 1

### *1.1 Question 3*

Find the Distance between $\left(-3,-2\right)$ and $\left(-6,7\right)$, the axes being inclined at 60

### *1.2 Solution*

Let $\mathbf{A}_a = \begin{pmatrix}-3\\-2\end{pmatrix}, \mathbf{B}_a = \begin{pmatrix}-6\\7\end{pmatrix}$
formula for finding Rectangular coordinates from angular coordinates $\mathbf{X} = \mathbf{P}\mathbf{X}_n$
where

| | |
|---|---|
| X | Rectangular coordinates |
| $X_a$ | Angular coordinates |
| P | $\begin{bmatrix}1 & \cos 60\\0 & \sin 60\end{bmatrix}$ |

$$\mathbf{P} = \begin{pmatrix}1 & \cos\theta\\0 & \sin\theta\end{pmatrix} \tag{1.2.1}$$

$$\mathbf{A}_a = \begin{pmatrix}1 & \cos 60\\0 & \sin 60\end{pmatrix}\begin{pmatrix}-3\\-2\end{pmatrix} \tag{1.2.2}$$

$$\mathbf{A} = \begin{pmatrix}-3-2\cos 60\\-2\sin 60\end{pmatrix} \tag{1.2.3}$$

$$\mathbf{B}_a = \begin{pmatrix}1 & \cos 60\\0 & \sin 60\end{pmatrix}\begin{pmatrix}-6\\7\end{pmatrix} \tag{1.2.4}$$

$$\mathbf{B} = \begin{pmatrix}-6+7\cos 60\\7\sin 60\end{pmatrix} \tag{1.2.5}$$

(1.2.6)

The distance between two vectors is given by

$$\|\mathbf{A}-\mathbf{B}\| = \sqrt{\left(\mathbf{A}-\mathbf{B}\right)^{\mathsf{T}}\left(\mathbf{A}-\mathbf{B}\right)} \tag{1.2.7}$$

$$\mathbf{A}-\mathbf{B} = \begin{pmatrix}-3-2\cos 60\\-2\sin 60\end{pmatrix} - \begin{pmatrix}-6+7\cos 60\\7\sin 60\end{pmatrix} \tag{1.2.8}$$

$$= \begin{pmatrix}3-9\cos 60^2\\-9\sin 60^2\end{pmatrix} \tag{1.2.9}$$

$$\left(\mathbf{A}-\mathbf{B}\right)^{\mathsf{T}} = \begin{pmatrix}3-9\cos 60^2 & -9\sin 60^2\end{pmatrix} \tag{1.2.10}$$

Replacing (**??**) and (1.2.10) in (1.2.8)

$$\|\mathbf{A}-\mathbf{B}\| = \sqrt{\begin{pmatrix}3-9\cos 60 & -9\sin 60\end{pmatrix}\begin{pmatrix}3-9\cos 60\\-9\sin 60\end{pmatrix}} \tag{1.2.11}$$

$$= \sqrt{\left(3-9\cos 60\right)^2+\left(-9\sin 60\right)^2} \tag{1.2.12}$$

$$= \sqrt{9+81\cos^2 60-54\cos 60+81\sin^2 60} \tag{1.2.13}$$

$$= \sqrt{9+81-54\cos 60} \tag{1.2.14}$$

$$= \sqrt{90-27}$$

$$= \sqrt{63}$$

$$= 7.9372$$

Distance between two points is 7.9372

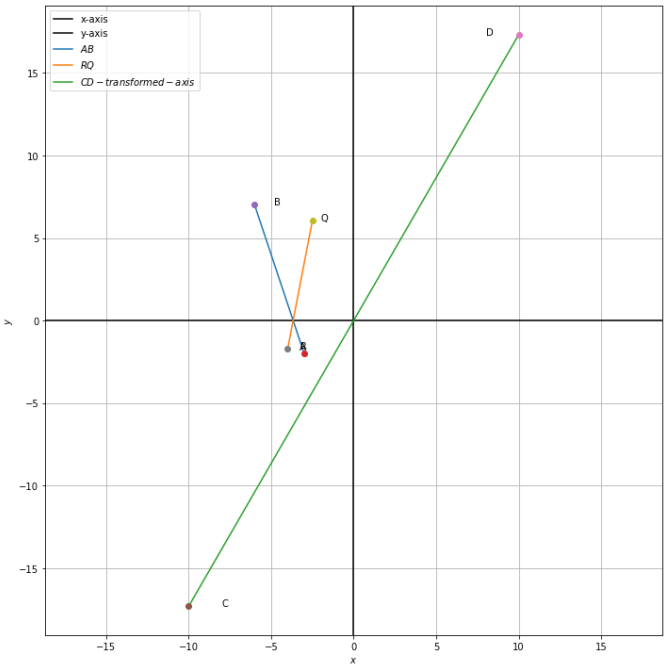


Fig. 0