## CHAPTER-7 COORDINATE GEOMETRY

## Excercise 7.1

Q1. Find the distance between the following pairs of points:

- 1. (2,3),(4,1)
- 2. (-5,7), (-1,3)
- 3. (a,b), (-a,-b)

## Solution:

1. The coordinates are given as

$$\mathbf{A} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \tag{1}$$

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} -2 \\ 2 \end{pmatrix} \tag{2}$$

$$(\mathbf{A} - \mathbf{B})^{\mathsf{T}} (\mathbf{A} - \mathbf{B}) = \begin{pmatrix} -2 & 2 \end{pmatrix} \begin{pmatrix} -2 \\ 2 \end{pmatrix} = 4 + 4 = 8$$
 (3)

$$d = \|\mathbf{A} - \mathbf{B}\| = \sqrt{(\mathbf{A} - \mathbf{B})^{\top} (\mathbf{A} - \mathbf{B})}$$
 (4)

$$d = \sqrt{(\mathbf{A} - \mathbf{B})^{\top} (\mathbf{A} - \mathbf{B})} = \sqrt{8} = 2\sqrt{2} = 2.828$$
 (5)

Hence the distance between the two points AB is 2.828 shown in Figure:1

2. The coordinates are given as

$$\mathbf{C} = \begin{pmatrix} -5\\7 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} -1\\3 \end{pmatrix} \tag{6}$$

$$\mathbf{C} - \mathbf{D} = \begin{pmatrix} -5\\7 \end{pmatrix} - \begin{pmatrix} -1\\3 \end{pmatrix} = \begin{pmatrix} -4\\4 \end{pmatrix} \tag{7}$$

$$(\mathbf{C} - \mathbf{D})^{\mathsf{T}} (\mathbf{C} - \mathbf{D}) = \begin{pmatrix} -4 & 4 \end{pmatrix} \begin{pmatrix} -4 \\ 4 \end{pmatrix} = 16 + 16 = 32$$
 (8)

$$d = \|\mathbf{C} - \mathbf{D}\| = \sqrt{(\mathbf{C} - \mathbf{D})^{\top} (\mathbf{C} - \mathbf{D})}$$
(9)

$$d = \sqrt{(\mathbf{C} - \mathbf{D})^{\top} (\mathbf{C} - \mathbf{D})} = \sqrt{32} = 4\sqrt{2} = 5.656$$
 (10)

Hence the distance between the two points CD is 5.656 shown in Figure:1

3. The coordinates are given as

$$\mathbf{E} = \begin{pmatrix} a \\ b \end{pmatrix}, \mathbf{F} = \begin{pmatrix} -a \\ -b \end{pmatrix} \tag{11}$$

$$\mathbf{E} - \mathbf{F} = \begin{pmatrix} a \\ b \end{pmatrix} - \begin{pmatrix} -a \\ -b \end{pmatrix} = \begin{pmatrix} 2a \\ 2b \end{pmatrix} \tag{12}$$

$$(\mathbf{E} - \mathbf{F})^{\top} (\mathbf{E} - \mathbf{F}) = \begin{pmatrix} 2a & 2b \end{pmatrix} \begin{pmatrix} 2a \\ 2b \end{pmatrix} = 4a^2 + 4b^2$$
 (13)

$$d = \|\mathbf{E} - \mathbf{F}\| = \sqrt{(\mathbf{E} - \mathbf{F})^{\top} (\mathbf{E} - \mathbf{F})}$$
 (14)

$$d = \sqrt{(\mathbf{E} - \mathbf{F})^{\top} (\mathbf{E} - \mathbf{F})} = \sqrt{4a^2 + 4b^2} = 2\sqrt{a^2 + b^2}$$
 (15)

Suppose, if a=1,b=2 , then d =  $2\sqrt{1^2+2^2}=4.472$ 

Hence the distance between the two points EF is  $2\sqrt{a^2+b^2}=4.472$  shown in Figure:1

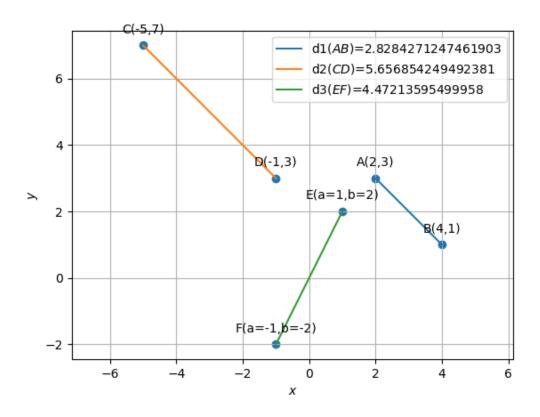


Figure 1: