Assignment 1

Rubeena Aafreen (EE20RESCH11012)
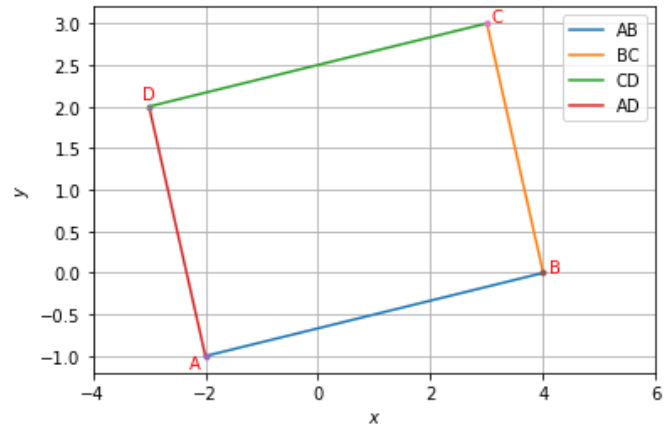
1 Problem

Without using distance formula, show that points $\begin{pmatrix} -2 \\ -1 \end{pmatrix}$, $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$, $(3,3)$ and $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ are the vertices of a parallelogram.

2 Explanation

Let points of quadrilateral be A, B, C, D such that,

$$A = \begin{pmatrix} -2 \\ -1 \end{pmatrix}, B = \begin{pmatrix} 4 \\ 0 \end{pmatrix}, C = \begin{pmatrix} 3 \\ 3 \end{pmatrix}, D = \begin{pmatrix} -3 \\ 2 \end{pmatrix} \quad (2.0.1)$$

We have vector equations for each side as:

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} -2 \\ -1 \end{pmatrix} - \begin{pmatrix} 4 \\ 0 \end{pmatrix} = \begin{pmatrix} -6 \\ -1 \end{pmatrix} \quad (2.0.2)$$

$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} 4 \\ 0 \end{pmatrix} - \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \end{pmatrix} \quad (2.0.3)$$

$$\mathbf{D} - \mathbf{C} = \begin{pmatrix} -3 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} -6 \\ -1 \end{pmatrix} \quad (2.0.4)$$

$$\mathbf{A} - \mathbf{D} = \begin{pmatrix} -2 \\ -1 \end{pmatrix} - \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \end{pmatrix} \quad (2.0.5)$$

3 Proof

Since,

$$\mathbf{A} - \mathbf{B} = \mathbf{B} - \mathbf{C} \quad (3.0.1)$$
$$\mathbf{B} - \mathbf{C} = \mathbf{A} - \mathbf{D} \quad (3.0.2)$$

We can say that opposite edges of the quadrilateral are parallel.

Hence, ABCD is a parallelogram

4 Result

Plot of quadrilateral obtained from Python code is shown below.

Fig. 0: Plot of parallelogram ABCD