ASSIGNMENT-2

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Download all python codes from

https://github.com/BOJJAVOYINAANUSHA/tree/main/Assignment−2.py

and latex-tikz codes from

https://github.com/BOJJAVOYINAANUSHA/tree/main/Assignment−2.tex

1 Question No. 2.42

Construct a ABCD where $AB = 4, BC = 5, CD = 6.5, \angle B = 105^\circ$ and $\angle C = 80^\circ$.

2 SOLUTION

Let us assume vertices of given quadrilateral $ABCD$ as **A**,**B**,**C** and **D**. Let us generalize the given data:

$$\angle B = 105^\circ = \theta \tag{2.0.1}$$
$$\angle C = 80^\circ = \alpha \tag{2.0.2}$$
$$\|\mathbf{B} - \mathbf{A}\| = 4 = a, \tag{2.0.3}$$
$$\|\mathbf{C} - \mathbf{B}\| = 5 = b, \tag{2.0.4}$$
$$\|\mathbf{D} - \mathbf{C}\| = 6.5 = c, \tag{2.0.5}$$
$$\mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}, \mathbf{C} = \begin{pmatrix}5\\0\end{pmatrix} \tag{2.0.6}$$

Also, Let us assume the other side is

$$\|\mathbf{D} - \mathbf{A}\| = d \tag{2.0.7}$$

- For this quadrilateral $ABCD$ we have,

$$\angle B + \angle C = 105^\circ + 80^\circ = 185^\circ, \tag{2.0.8}$$

- Let,

$$\mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}, \mathbf{C} = \begin{pmatrix}5\\0\end{pmatrix}. \tag{2.0.9}$$

- For Finding co-ordinates of A:- Now we will use vector equation of a line,

$$\mathbf{A} = \mathbf{B} + \lambda a \tag{2.0.10}$$
$$\implies \mathbf{A} = \mathbf{B} + \lambda \times \begin{pmatrix}cos105^\circ\\sin105^\circ\end{pmatrix} \tag{2.0.11}$$
$$\implies \|\mathbf{A} - \mathbf{B}\| = |\lambda| \times \left\|\begin{pmatrix}-0.258\\0.965\end{pmatrix}\right\| \tag{2.0.12}$$
$$\implies 4 = |\lambda| \times 1 \tag{2.0.13}$$
$$\implies \lambda = 4 \tag{2.0.14}$$

- Now we will calculate the co-ordinates of A,

$$\mathbf{A} = \mathbf{B} + 4\begin{pmatrix}-0.258\\0.965\end{pmatrix} \tag{2.0.15}$$
$$\implies \mathbf{A} = \begin{pmatrix}0\\0\end{pmatrix} + \begin{pmatrix}-1.035\\3.863\end{pmatrix} \tag{2.0.16}$$
$$\implies \mathbf{A} = \begin{pmatrix}-1.035\\3.863\end{pmatrix} \tag{2.0.17}$$

- For Finding co-ordinates of D:- Using the vector equation of a line,

$$\mathbf{D} = \mathbf{C} + \lambda m \tag{2.0.18}$$
$$\implies \mathbf{D} - \mathbf{C} = \lambda \times \begin{pmatrix}cos100^\circ\\sin100^\circ\end{pmatrix} \tag{2.0.19}$$
$$\implies \|\mathbf{D} - \mathbf{C}\| = |\lambda| \times \left\|\begin{pmatrix}-0.173\\0.984\end{pmatrix}\right\| \tag{2.0.20}$$
$$\implies 6.5 = |\lambda| \times 1 \tag{2.0.21}$$
$$\implies \lambda = 6.5 \tag{2.0.22}$$

- Now we will calculate the co-ordinates of D,

$$\mathbf{D} = \mathbf{C} + \lambda \times \begin{pmatrix}cos100^\circ\\sin100^\circ\end{pmatrix} \tag{2.0.23}$$

$$\implies \mathbf{D} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + 6.5 \times \begin{pmatrix} -0.173 \\ 0.984 \end{pmatrix} \tag{2.0.24}$$

$$\implies \mathbf{D} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + \begin{pmatrix} -1.128 \\ 6.401 \end{pmatrix} \tag{2.0.25}$$

$$\mathbf{D} = \begin{pmatrix} 3.871 \\ 6.401 \end{pmatrix} \tag{2.0.26}$$

Now, we have the coordinate of vertices A,B,C,D as,

$$\mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} -1.035 \\ 3.863 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 3.871 \\ 6.401 \end{pmatrix}. \tag{2.0.27}$$

On constructing the given quadilateral on python and marking angle we get:

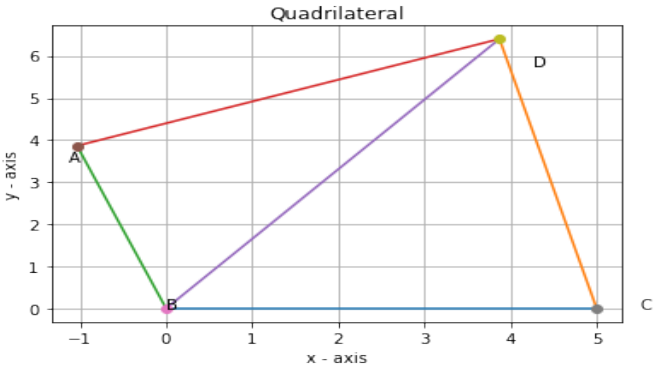

Fig. 2.1: Quadrilateral ABCD