ASSIGNMENT-2

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Download all python codes from

https://github.com/BOJJAVOYINAANUSHA/Assignment−2/blob/main/ASSIGNMENT2/assignment2.py

and latex-tikz codes from

https://github.com/BOJJAVOYINAANUSHA/Assignment−2/blob/main/ASSIGNMENT2/main.tex

1 Question No. 2.42

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

2 SOLUTION

1) Let us assume vertices of given quadrilateral $ABCD$ as $\mathbf{A}$,$\mathbf{B}$,$\mathbf{C}$ and $\mathbf{D}$.
2) Let us generalize the given data:

$$\angle B = 105° = \theta \tag{2.0.1}$$
$$\angle C = 80° = \alpha \tag{2.0.2}$$
$$\|\mathbf{A} - \mathbf{B}\| = 4 = a, \tag{2.0.3}$$
$$\|\mathbf{C} - \mathbf{B}\| = 5 = b, \tag{2.0.4}$$
$$\|\mathbf{D} - \mathbf{C}\| = 6.5 = c, \tag{2.0.5}$$

- For this quadrilateral $ABCD$ we have,

$$\angle B + \angle C = 105° + 80° = 185° \tag{2.0.6}$$

- Let,

$$\mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \tag{2.0.7}$$

Lemma 2.1. *The coordinate of A and D can be written as follows:*

$$\implies \mathbf{A} = \begin{pmatrix} B \end{pmatrix} + a \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{2.0.8}$$
$$\implies \mathbf{D} = \begin{pmatrix} C \end{pmatrix} + c \begin{pmatrix} \cos\alpha \\ \sin\alpha \end{pmatrix} \tag{2.0.9}$$

Proof. • For finding coordinates of A:-
The vector equation of line is given by:

$$\mathbf{A} = \mathbf{B} + \lambda m \tag{2.0.10}$$

$$\|\mathbf{A} - \mathbf{B}\| = |\lambda| \times \| \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \| \tag{2.0.11}$$
$$\implies \|\mathbf{A} - \mathbf{B}\| = |\lambda| \tag{2.0.12}$$

Now using (2.0.2) and putting its value in above equation,we get

$$\implies |\lambda| = a \tag{2.0.13}$$

- For finding coordinates of D:-

The vector equation of line is given by:

$$\mathbf{D} = \mathbf{C} + \mu m \tag{2.0.14}$$

$$\|\mathbf{D} - \mathbf{C}\| = |\mu| \times \| \begin{pmatrix} \cos\beta \\ \sin\beta \end{pmatrix} \| \tag{2.0.15}$$
$$\implies \|\mathbf{D} - \mathbf{C}\| = |\mu| \tag{2.0.16}$$

Now using (2.0.5) and putting its value in above equation,we get

$$\implies |\mu| = c \tag{2.0.17}$$

□

3) Putting value of λ=4 in (2.0.13) and using (2.0.1) we get,

$$\implies \mathbf{A} = \mathbf{B} + a \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{2.0.18}$$
$$\implies \mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 4 \begin{pmatrix} \cos 105° \\ \sin 105° \end{pmatrix} \tag{2.0.19}$$
$$\implies \mathbf{A} = \begin{pmatrix} -1.03 \\ 3.86 \end{pmatrix} \tag{2.0.20}$$

4) Putting value of μ=6.5 in (2.0.14) and using

(2.0.2) we get,

$$\implies \mathbf{D} = \mathbf{C} + c\begin{pmatrix}\cos\alpha \\ \sin\alpha\end{pmatrix} \tag{2.0.21}$$

$$\implies \mathbf{D} = \begin{pmatrix}5 \\ 0\end{pmatrix} + 6.5\begin{pmatrix}\cos 80^\circ \\ \sin 80^\circ\end{pmatrix} \tag{2.0.22}$$

$$\implies \mathbf{D} = \begin{pmatrix}6.12 \\ 6.39\end{pmatrix} \tag{2.0.23}$$

- Now,the vertices of given Quadrilateral ABCD can be written as,

$$\mathbf{A} = \begin{pmatrix}-1.03 \\ 3.86\end{pmatrix}, \mathbf{B} = \begin{pmatrix}0 \\ 0\end{pmatrix}, \mathbf{C} = \begin{pmatrix}5 \\ 0\end{pmatrix}, \mathbf{D} = \begin{pmatrix}6.12 \\ 6.39\end{pmatrix} \tag{2.0.24}$$

5) On constructing the quadrilateral $ABCD$ we get:

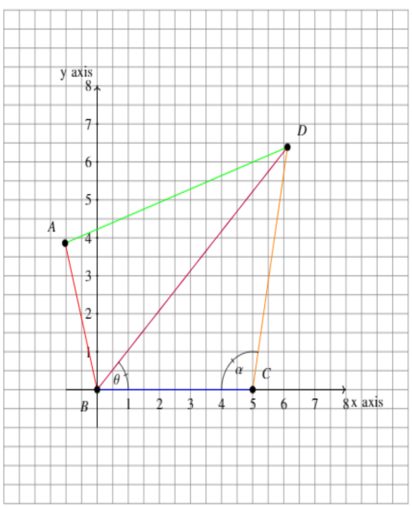

Fig. 2.1: Quadrilateral ABCD