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

2 SOLUTION

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

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

- For this quadrilateral $ABCD$ we have,

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

- Let,

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

- Also, Let us assume the other side is

$$\|\mathbf{D} - \mathbf{A}\| = d \tag{2.0.8}$$

- For finding coordinates of A:-

Proof. The vector equation of line is given by:

$$\mathbf{A} = \mathbf{B} + \lambda m \tag{2.0.9}$$

$$\|\mathbf{A} - \mathbf{B}\| = |\lambda| \times \left\| \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \right\| \tag{2.0.10}$$
$$\implies \|\mathbf{A} - \mathbf{B}\| = |\lambda| \tag{2.0.11}$$

Now using (2.0.3) and putting its value in above equation,we get

$$\implies |\lambda| = a \tag{2.0.12}$$

□

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

$$\implies \mathbf{A} = \left(B\right) + \lambda \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{2.0.13}$$

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

$$\implies \mathbf{A} = \mathbf{B} + a \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{2.0.14}$$
$$\implies \mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 4 \begin{pmatrix} \cos 105^\circ \\ \sin 105^\circ \end{pmatrix} \tag{2.0.15}$$
$$\implies \mathbf{A} = \begin{pmatrix} -1.035 \\ 3.863 \end{pmatrix} \tag{2.0.16}$$

- For finding coordinates of D:-

Proof. The vector equation of line is given by:

$$\mathbf{D} = \mathbf{C} + \mu m \tag{2.0.17}$$

$$\|\mathbf{D} - \mathbf{C}\| = |\mu| \times \left\| \begin{pmatrix} \cos\beta \\ \sin\beta \end{pmatrix} \right\| \tag{2.0.18}$$
$$\implies \|\mathbf{D} - \mathbf{C}\| = |\mu| \tag{2.0.19}$$

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

$$\implies |\mu| = c \tag{2.0.20}$$

□

Lemma 2.2. *The coordinate of D can be*

written as:

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

- Putting value of μ=6.5 in (2.0.21) and using (2.0.8) we get,

$$\implies \mathbf{D} = \mathbf{C} + c \begin{pmatrix} \cos\beta \\ \sin\beta \end{pmatrix} \tag{2.0.22}$$

$$\implies \mathbf{D} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + 6.5 \begin{pmatrix} \cos 100^\circ \\ \sin 100^\circ \end{pmatrix} \tag{2.0.23}$$

$$\implies \mathbf{D} = \begin{pmatrix} 3.871 \\ 6.401 \end{pmatrix} \tag{2.0.24}$$

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

$$\mathbf{A} = \begin{pmatrix} -1.035 \\ 3.863 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 3.871 \\ 6.401 \end{pmatrix} \tag{2.0.25}$$

- On constructing the quadrilateral $ABCD$ we get:

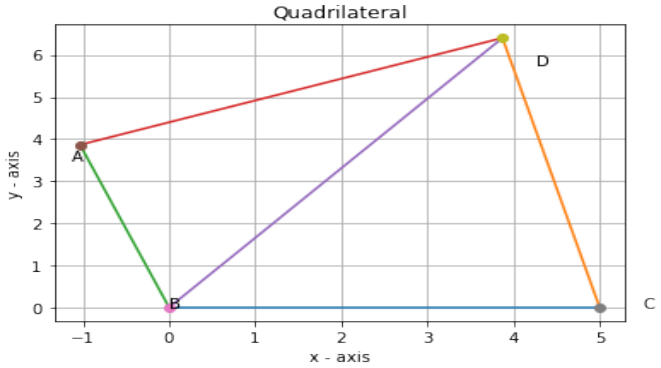

Fig. 2.1: Quadrilateral ABCD