ASSIGNMENT-2

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Download all python codes from

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

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

- 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:*

$$\implies \mathbf{A} = \mathbf{B} + |\lambda| \begin{pmatrix} \cos B \\ \sin B \end{pmatrix} \tag{2.0.8}$$
$$\implies \mathbf{D} = \mathbf{C} + |\mu| \begin{pmatrix} \cos C \\ \sin C \end{pmatrix} \tag{2.0.9}$$

3) For finding coordinates of A:- The vector equation of line is given by:

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

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

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

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

4) For finding coordinates of D:- The vector equation of line is given by:

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

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

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

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

5) Putting (2.0.13) in (2.0.8) and using (2.0.3) we get,

$$\implies \mathbf{A} = \mathbf{B} + p \begin{pmatrix} \cos 105 \\ \sin 105 \end{pmatrix} \tag{2.0.18}$$
$$\implies \mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 4 \begin{pmatrix} -0.25 \\ 0.96 \end{pmatrix} \tag{2.0.19}$$
$$\implies \mathbf{A} = \begin{pmatrix} -1.03 \\ 3.86 \end{pmatrix} \tag{2.0.20}$$

6) Putting (2.0.17) in (2.0.9) and using (2.0.2) we

get,

$$\implies \mathbf{D} = \mathbf{C} + r\begin{pmatrix} \cos 80 \\ \sin 80 \end{pmatrix} \tag{2.0.21}$$

$$\implies \mathbf{D} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + 6.5\begin{pmatrix} 0.17 \\ 0.98 \end{pmatrix} \tag{2.0.22}$$

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

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

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

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

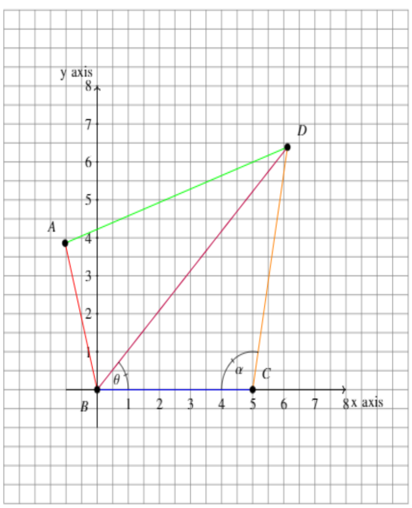

Fig. 2.1: Quadrilateral ABCD